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# Vital Care™
# 506DXNTP2 Series
# Service Manual

CRITICARE
SYSTEMS, INC.

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# Section 1 — Introduction

## Description

The 506DX2 VitalCare™ monitor is a compact vital signs monitor that measures the following three critical parameters:

- Temperature (normal or monitoring mode )
- Non-invasive blood pressure (NIBP) (oscillometric on inflation)
- Oxygen saturation SpO2 (digital)

The 506 DXNTP2 has the same features as the 506DX2, and is also equipped with a thermal printer to allow printing of vital signs measurements and trend data.

**NOTE**

- In the manual, the term "506DX2" refers to either the 506DXN2, 506DXNP2, 506DXNT2, 506DXNTP2,unless otherwise specified.

## About this Manual

This manual contains only the information required to service the monitor. For information on operation, monitoring, and setting up the monitor, consult the Operator's Manual for the 506DX2.

This manual is designed to help diagnose and service the sub assembly or circuit board level of the 506DX2 and DXNTP monitors.

Parts lists and block diagrams have been included to help the technician understand how the monitor systems operate.

Criticare Systems Inc. does not intend service to be performed on the circuit boards by anyone except the Criticare Service Department.

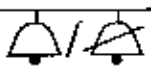
## Equipment Required for Service

The following equipment is recommended to correctly perform monitor testing. All part numbers and catalog numbers are CSI numbers unless otherwise noted.

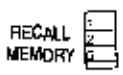
| | Instrument | Recommended Characteristics | Recommended Model |
|---|---|---|---|
| 1. | Digital multi-meter | 4½ digit | Fluke # 8060A |
| 2. | Test finger sensor | | Cat. No. 511 10L |
| 3. | Hypot tester | 4000 VAC max. | Kikusui TOS 8700 |
| 4. | Capacitor | 2200 picofarad | Part No. 20004B019 |
| 5. | Power adapter/charger | | Cat. No. 908 |
| 6. | $SpO_2$ simulator | | Cat No. 913AD |
| 7. | 700 cc dummy cuff | | Part No. 95513A001 |
| 8. | Manometer | | |
| 9. | NIBP simulator | | Dynatech Cufflink |
| 10. | Barrel. Lemo connector | | Part No. 40009B001 |
| 11. | Variable power supply | 10-15VDC/50 amp | |
| 12. | Power test cable | | Fabricate - See Sect. 4 |
| 13. | Leakage tester | | Dyna Tech model 232 |
| 14. | Battery load simulator cable | | |
| 15. | Temperature simulator | | IVAC |
| 16. | Frequency counter | | |
| 17. | Oscilloscope | 100MHz or better | |
| 18. | Temperature probe | | CSI cat. no. 444 |

## Symbols

The following table explains the meaning of safety-related symbols that are used on the front and rear panels of the 506DXNT monitor.

| Symbol | Means |
|---|---|
| | Refer to Operator's Manual for information |
| | Alternating current |
| I/O | Power ON/OFF switch |
|  | Temperature |
| | Systolic blood pressure |
| | Mean blood pressure |
| | Diastolic blood pressure |
|  | Alarms on/off key |
|  | Sensor off |
| | Neonatal mode |
| | Battery charge low |
| | AC power on |
| | Do not connect any sensor to this connector |
| | Noninvasive blood pressure (NIBP) |
| | NIBP stop |
| | Print |

## Symbols (cont.)

| | |
|---|---|
| | Paper feed |
| | Manual mode |
| | Type CF equipment |
| | Defibrillator-proof Type CF equipment |
| | NIBP Cycle |
|   | Recall Memory |
| CE | European Community |

## Safety

*Special statements* are preceded by the Danger, Warning, Caution, or Note heading. These statements contain important instructions which often relate to safety.

**DANGER** indicates probable personal injury to you or others if instructions are not followed.

**WARNING** indicates possible personal injury to you or others if instructions are not followed.

**CAUTION** indicates possible damage to the equipment if instructions are not followed.

**NOTE** is used to emphasize important information.

* Underwriter's Laboratories (UL) 544 and the International Electrotechnical Commission (IEC) 601-1, 2nd edition, 1988 Part 1.

## Electrical

**⚠ WARNING ⚠**

- Use the 506DXNT patient monitor only with the supplied Criticare charger (CSI Cat. Nos.905 or 908) and power cord. Use of a non-approved charger and/or cord can cause electrical shock hazard to the operator or patient.
- Use hospital-grade outlets only.
- All devices connected to the 506DXNT must be powered from the same main branch circuit. Failure to comply with this requirement can cause electric shock resulting in patient injury or death and/or equipment damage.
- The 506DXNT patient monitor is designed to protect the patient against burns when used properly with HF surgical equipment. The operator must guarantee the integrity of the HF surgical neutral electrode connection. Noncompliance could result in burns to the patient.
- *All devices connected to the 506DXNT monitor must meet* applicable IEC standards. Connected devices not meeting these standards can endanger the safety of the patient and the operator.
- Do not short circuit the battery terminals! The resulting high-current discharge can cause burns.

**⚠ WARNING ⚠**

- All accessories ( sensors, etc.) connected to the 506DXNT monitor must meet applicable IEC standards. Accessories not meeting these standards can endanger the safety of the patient and the operator.
- Charge the battery COMPLETELY following extended battery use to ensure a fully-charged battery is available for the next use.
- Do not use any sensor cables on the 506DXNT monitor if cable wires are exposed. Doing so could create a shock hazard.

**⚠ CAUTIONS ⚠**

- Do not apply more than 5VDC to the connectors on the monitor's side panel. More than 5VDC can damage the equipment.
- Remove the main battery before performing any service, testing, or maintenance procedures.

**NOTES**

- The 506DXNT2 monitor complies with leakage current limits required by medical safety standards for patient connected devices. However, there is a possible hazard caused by the summation of leakage currents when several pieces of equipment are interconnected.

## Blood Pressure (NIBP)

Criticare assumes no responsibility for any blood pressure transducers used with the 506DXNT monitor.

**⚠ WARNING ⚠**

- Do not use a BP cuff that does not fit the patient. Accuracy of blood pressure readings depends on using a properly sized cuff. The American Heart Association recommends that the width of the cuff should be either 40% of upper arm circumference or 2/3 of upper arm length.
- If a patient experiences a sudden dramatic drop in blood pressure, the monitor may not detect the pressure on the first attempt. The monitor will detect the change after additional attempts.
- The accuracy of non-invasive blood pressure readings may be adversely affected by the presence of agents which alter the patient's cardiovascular dynamics.
- The sensitivity of invasive and non-invasive blood pressure monitoring may be affected when used on patients with intra-aortic balloon pumps.
- Interference or errors in readings may be caused by the presence of electrocautery or diathermy interference.
- Be sure to set the monitor to the correct patient mode (neonate or adult) before monitoring each patient. When monitoring neonates, remain present to observe the first NIBP measurement to ensure that the monitor is functioning as intended.

## Temperature

**⚠ WARNING ⚠**

- Use a new temperature probe cover for each patient. If a new temperature probe cover is not used for each patient, disease or infection could result.

## Pulse Oximeter

**⚠ WARNING ⚠**

- The pulse oximeter sensor could cause skin irritation and pressure necrosis. Inspect the pulse oximeter sensor site every two to four hours. Move the sensor to a different location if any skin irritation is present.
- The pulse oximeter sensor is light sensitive. Too much ambient light makes it impossible for the system to provide accurate readings. The system provides a high ambient light alarm when it is necessary to shield the sensor from extraneous light sources such as phototherapy light or infrared heating lamps.
- Do not tape over the pulse oximeter sensor housing. Taping over the housing could cause injury and sensor failure due to excessive pressure. If the sensor needs to be secured, place tape over the cable, immediately behind the sensor.
- Do not connect any patient sensor to any connector other than its intended connector. Patient injury may result.
- Do not place the pulse oximeter sensor on the same extremity with the blood pressure cuff or an arterial line. Place the pulse oximeter sensor on the side of the patient opposite the blood pressure cuff or an arterial line. The occlusion of the blood flow during blood pressure determinations could affect saturation readings.

## General

**⚠ WARNING ⚠**

- A possible explosion hazard exists. Do not use the 506DXNT monitor in the presence of flammable anesthetics. The 506DXNT monitor is not suitable for use in the presence of a flammable anesthetic mixture with air, oxygen, or nitrous oxide.
- Explosion hazard! Keep lighted cigarettes, sparks, and flames away from the battery.
- *The battery contains sulfuric acid electrolyte which can* cause severe burns and eye damage, as well as illness from sulfur oxide fumes.
- Do not crack, cut, burn, or dissolve (with solvents) the battery case. Damaging the battery case can cause the release of sulfuric acid. If sulfuric acid is released from the *battery, wear eye protection and rubber gloves to handle* the battery, and use a solution of baking soda in water to neutralize the sulfuric acid.
- A possible burn hazard exists. Use care in operating other equipment (e.g., ESU) on the patient while the patient is connected to a patient monitor.
- All accessories connected to the 506DXNT monitor, including $SpO_2$ sensors, blood pressure cuffs, temperature probes, I/O connectors, or any other accessories, must comply with all applicable UL (Underwriter's Laboratories) standards and IEC standards for such products.

**⚠ CAUTIONS ⚠**

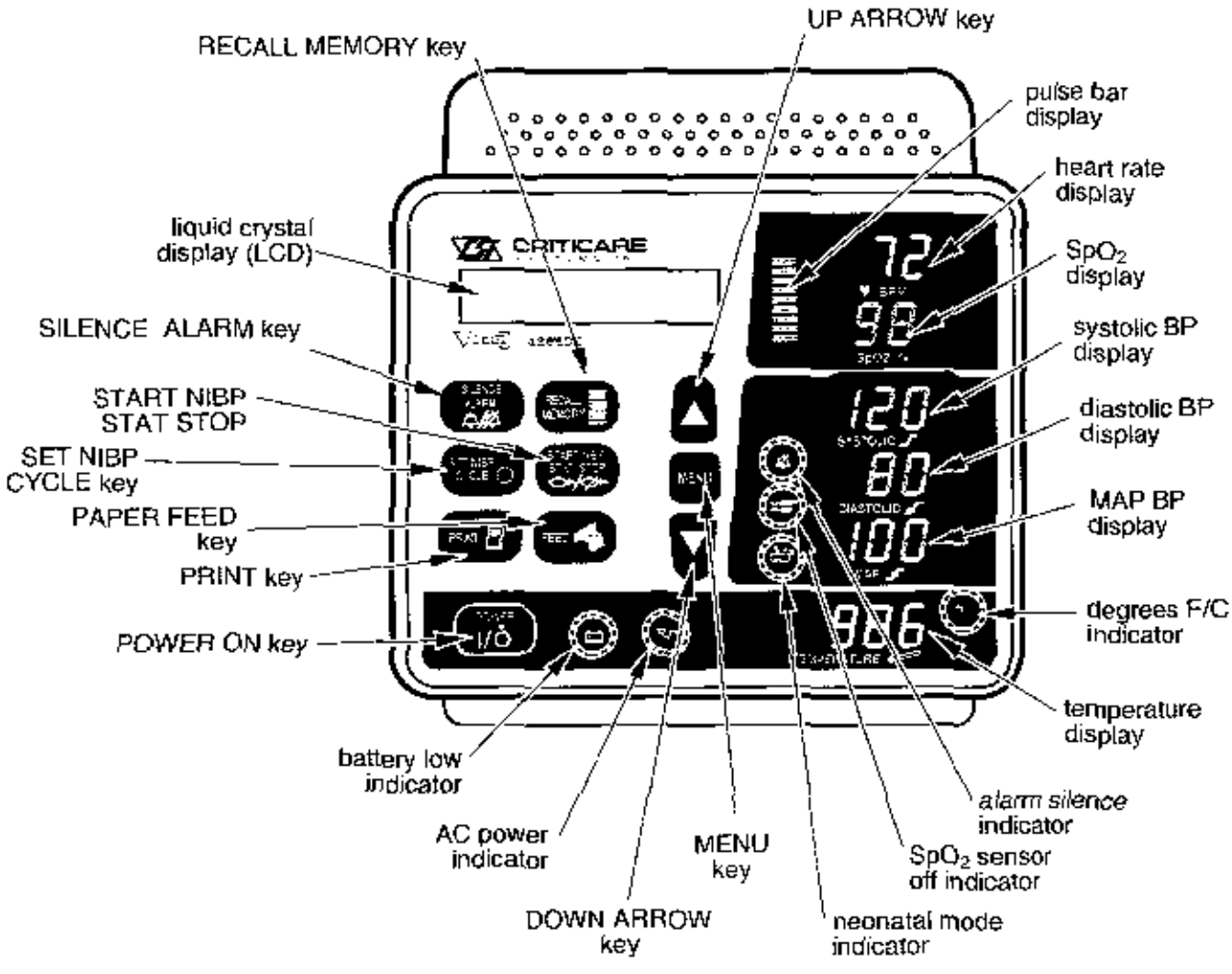
- Do not store equipment at extreme temperature. Storage temperature should be -5 to 50° C (23 to 122° F). Temperatures exceeding these limits could damage the system.
- Federal (USA) law restricts this device to sale by or on the order of a physician.

**⚠ CAUTIONS ⚠**

- Do not stretch sensor cables. Store cables carefully after forming them into loose loops. If cables are stretched, electrical failures could result.
- Do not press on the keys with surgical instruments or other tools. Use only your fingertips to press on the keys. Sharp or hard objects could damage the keys.
- Environmental hazard! When replacing the battery, dispose of the old battery with automotive battery scrap in accordance with local and federal laws. Do not incinerate.

**NOTE**

- Excessive amounts of motion at the sensor sites could cause errors in readings. Take new readings when motion has stopped, or move the sensor to another site.
- Equipment accuracy at extreme temperatures could be affected. For optimum performance, operating environment should have a room temperature of 10-40° C (50-104° F) and a relative humidity of 15-90% (non-condensing).
- The rechargeable battery is a sealed lead-acid-type battery and is totally maintenance free. If the battery becomes defective, it should be replaced (see the Battery Replacement Procedure in **Section 7 -- Disassembly**).




**Front Panel 506DXNTP2 monitor**

# Section 2 — Specifications

## Specifications

**Pulse Rate Display and Alarms**

| | |
|---|---|
| Source: | $SpO_2$ or NIBP |
| Resolution: | 1 BPM |
| Range: | 20-300 BPM |
| Accuracy: | Greater of ±1% or ± 1 BPM<br>Unspecified for <40 or >290 BPM |

**Non-Invasive Blood Pressure**

| | |
|---|---|
| Technique: | Automatic oscillometric upon inflation |
| Pressure Range: | Adult mode: 30-300 mmHg<br>Neonate mode: 30-150 mmHg |
| Maximum Inflation Pressure: | 300 mmHg Adult, 150mmHg Neonatal |
| Accuracy: | Greater of ±2% or ±2 mmHg over full range |
| Measurement Cycle: | <40 sec avg. (0-300 mm Hg: Standard Adult Cuff) |
| Automatic Measurement Cycles: | 2, 3, 5, 10, 15, 30, 45 or 60 minutes; 2 or 4 hours.<br>STAT function initiates 5 minutes of consecutive NIPB measurements |

**Oxygen Saturation ($SpO_2$)**

| | |
|---|---|
| Averaging Time: | Selectable, 3, 6, 9, 12, 15, 18, or 21 seconds |
| Search Time: | Selectable, 10, 20, 30, or 40 seconds |
| Sensor Type: | Reusable or disposable |
| Range: | 1-99% |
| Resolution: | 1% |
| Accuracy: | ± 2% (70-99%); ±3% (40-69%); unspecified below 40% |
| Method: | Dual-wavelength LED |

**Temperature**

| | | |
|---|---|---|
| (506DXNT only) | Range: | Normal mode: 32.2°C to 42.2°C (90.0°F to 108.0°F)<br>Monitor mode: 26.7°C to 42.2°C (80.0°F to 108.0°F) |
| | Resolution: | ±0.1°C (±0.2°F) |
| | Accuracy: | ±0.1°C (±0.2°F) When tested in a calibrated water bath (in monitor mode) |

## Specifications (cont.)

### Power Requirements

**⚠ WARNING ⚠**

- Do not connect the monitor directly to any external power source!
- In order to ensure compliance with applicable IEC standards, use only the CSI Cat. No. 905 or 908 charger.

Charger/transformer.
Charger Input Rating: Cat No. 908: 110 to 120V ∿, 50/60Hz
*Cat No. 905: 225 to 240V ∿, 50/60Hz*

**Operating Environment**

| | |
|---|---|
| Temperature: | 10° to 40° C (50° to 104° F) |
| Humidity: | 15 to 90% (noncondensing) |
| Atmospheric Pressure: | 619 to 775 mmHg (825 to 1033hPa) |

**Transport and Storage Environment**

| | |
|---|---|
| Temperature: | -5° to 50° C (23° to 122° F) |
| Humidity: | 15 to 90% (non condensing) |
| Atmospheric Pressure: | 619 to 775 mmHg (825 to 1033 hP) |
| Storage Temperature: | -20° to 50°C (-4° to 122°F) |

**Display**

| | |
|---|---|
| Type: | LCD . LED |

**Printer**

| | |
|---|---|
| Printer type: | 2" (46mm) direct thermal |
| Print speed: | 46 characters / sec |
| Print resolution: | 8 V x 192 H dots / line |
| Paper type: | 58 mm thermal paper, CSI Cat. No. 553 |

System Output

| | |
|---|---|
| Digital (to serial printer. *to computer):* | *DIN-8* |
| Analog output: | DIN-8 for channel A or B (select one). ± 1V range |

**Battery**

| | |
|---|---|
| Type: | Rechargeable lead-acid (sealed) |
| Rating: | 6V. 4 A-H |
| Life: | 6 to 8 hours |
| Recharge Time: | 16 hours to 100% capacity (506DX Series)<br>6 hours to 100% capacity (506DX-2 Series) |

**Physical**

| | |
|---|---|
| *Size:* | *6.75"H x 6.125" W x 6.125" D*<br>(17.15cm H x 15.56cm W x 15.56 cm D) |
| Weight: | 4.4 lbs. (2.2 kg) |

## Specifications (cont.)

**Classifications**

| | |
|---|---|
| Type of Protection: | Class II Equipment |
| Degree of Protection: | Type CF Equipment ($SpO_2$, temperature)<br>Type CF Equipment, Defibrillator-Proof (NIBP only) |
| Protection Against Liquids: | IPX 1 rating, Drip-Proof Equipment |
| UL File Number: | E111532 Voulume 1, Section 11 |
| Degree of safety of application in the presence of a flammable anesthetic mixture with air or with nitrous oxide: | Equipment not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide. |
| Mode of operation: | Continuous operation |

**NOTE**

- All specifications are subject to change without notice.

# Section 3 — Theory of Operation

## Function Descriptions

### Pulse Oximetry ($SpO_2$)

The percentage of oxygenated hemoglobin is determined by using principles of spectrophotometry. The sensor consists of LEDs and a photodetector. The LEDs emit two specific wavelengths of light (red and infrared). The light waves are beamed through the patient tissue. One wavelength is absorbed more by molecules of hemoglobin that are combined with oxygen molecules (oxyhemoglobin). The second wavelength is absorbed *more by molecules of hemoglobin that are* **not** combined with oxygen (deoxyhemoglobin, or reduced hemoglobin). The photodetector measures the portion of each wavelength that passes through the patient tissue and is not absorbed.

When measuring $SpO_2$, the following are known:

- The relative amounts of each wavelength (red and infrared) of light received at the sensor
- The rate at which oxyhemoglobin and deoxyhemoglobin absorb these wavelengths

From these values, the amount of oxyhemoglobin and deoxyhemoglobin present in the bloodstream can be determined. This makes it possible to calculate the percent of oxygenated hemoglobin ($SpO_2$) by using the following formula.

$$\% \text{ oxygen saturation} = \frac{\text{Oxyhemoglobin}}{\text{Oxyhemoglobin} + \text{Deoxyhemoglobin}} \times 100$$

Dyshemoglobins, such as carboxyhemoglobin and methemoglobin, are not directly measured and are not factored into the measurement.

## Non-Invasive Blood Pressure

The 506DX2 monitors determine non-invasive blood pressure automatically using oscillometry. The oscillometric method detects volume displacements within the artery and senses pressure variations within the blood pressure cuff.

The 506DX2 monitors measure pressure changes in a standard blood pressure cuff while the cuff is being inflated. An average measurement on a still patient takes less than 40 seconds. At the end of each measurement, the cuff automatically deflates. The monitor will automatically attempt a second measurement if it cannot calculate a blood pressure on the first inflation (with no displayed error message).

### CUFF PRESSURE AND INFLATION RATE

The blood pressure module works in either adult or neonate mode. The maximum cuff inflation rate is 15 mm Hg/sec. The maximum allowable cuff pressure is 300 mm Hg for adult mode and 150 mm Hg for neonatal. Cuff pressure is allowed to remain above 300 mm Hg for a maximum of 2 minutes. The monitor automatically deflates the cuff if the time limit is violated. It contains hardware protection for overpressure conditions, pressure transducer failures, or microprocessor failures.

### DESCRIPTION OF NIBP MEASUREMENT CYCLE

(See Figure 3-1.) As the cuff pressure approaches the diastolic pressure of the patient, the cuff pressure waveform begins to indicate the pulse waveform. The cuff pressure at this point is equal to the patient's diastolic pressure, which is stored by the monitor. As cuff pressure continues to increase, the pulse waveform (as measured from BP cuff pressure fluctuation) becomes stronger, reaching its maximum at the patient's mean arterial pressure (when cuff pressure=mean BP). The monitor stores this value as mean pressure.

As cuff pressure increases further, it approaches the patient's systolic pressure, and the cuff pulse waveform decreases in amplitude. The cuff pulse waveform disappears at the point where cuff pressure is equal to the patient's systolic pressure. When the monitor determines that the cuff waveform has decreased to zero amplitude, it stores the cuff pressure value as the systolic pressure, and releases the pressure from the cuff. This typically occurs at about 10 mmHg over the patient's systolic pressure. The cuff then rapidly deflates.

## Non-Invasive Blood Pressure (cont.)

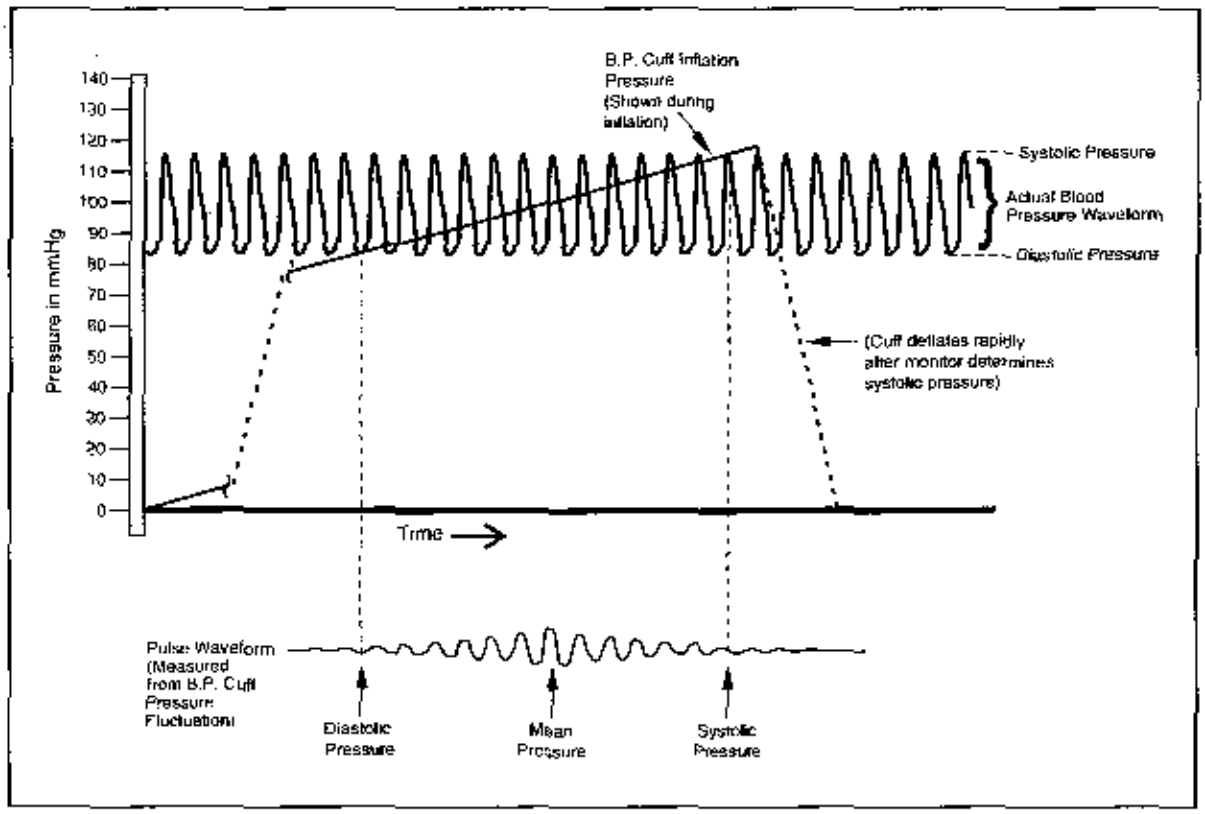



**Figure 3-1. NIBP Cuff Pressure and Pulse over Time.**

## Block Diagrams

Figures 3-2 through 3-3 are block diagrams of the 506DX2. Figure 3-2 is a system-level block diagram of the 506DX2. Figure 3-3 is an overall hardware block diagram of the 506DX2. *Figure 3-4* depicts the Main Board, Display Board, and $SpO_2$ Board circuits. Figure 3-5 illustrates the Blood Pressure Board circuits.

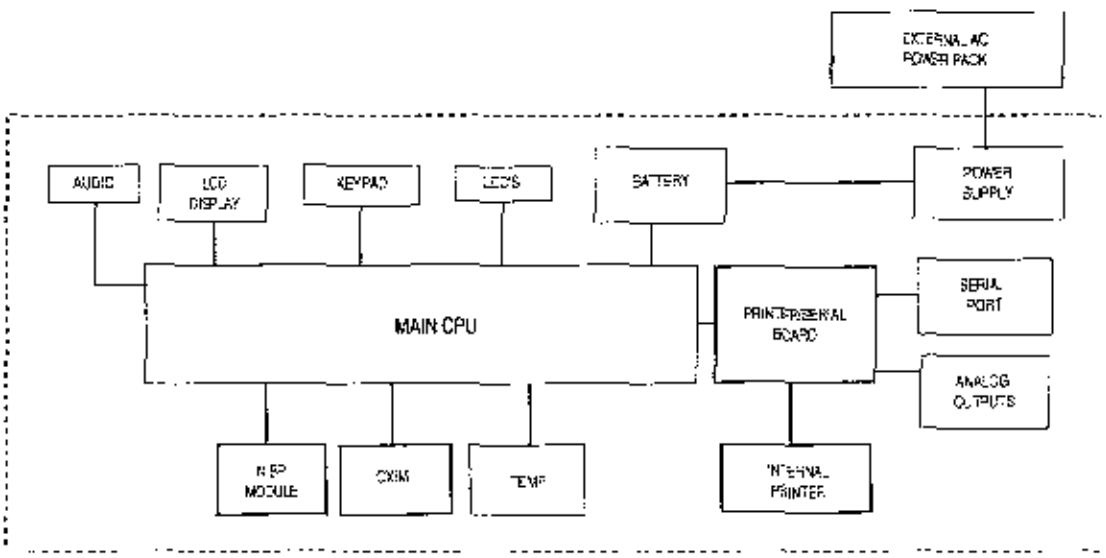



**Figure 3-2. 506DX2 System-Level Block Diagram.**

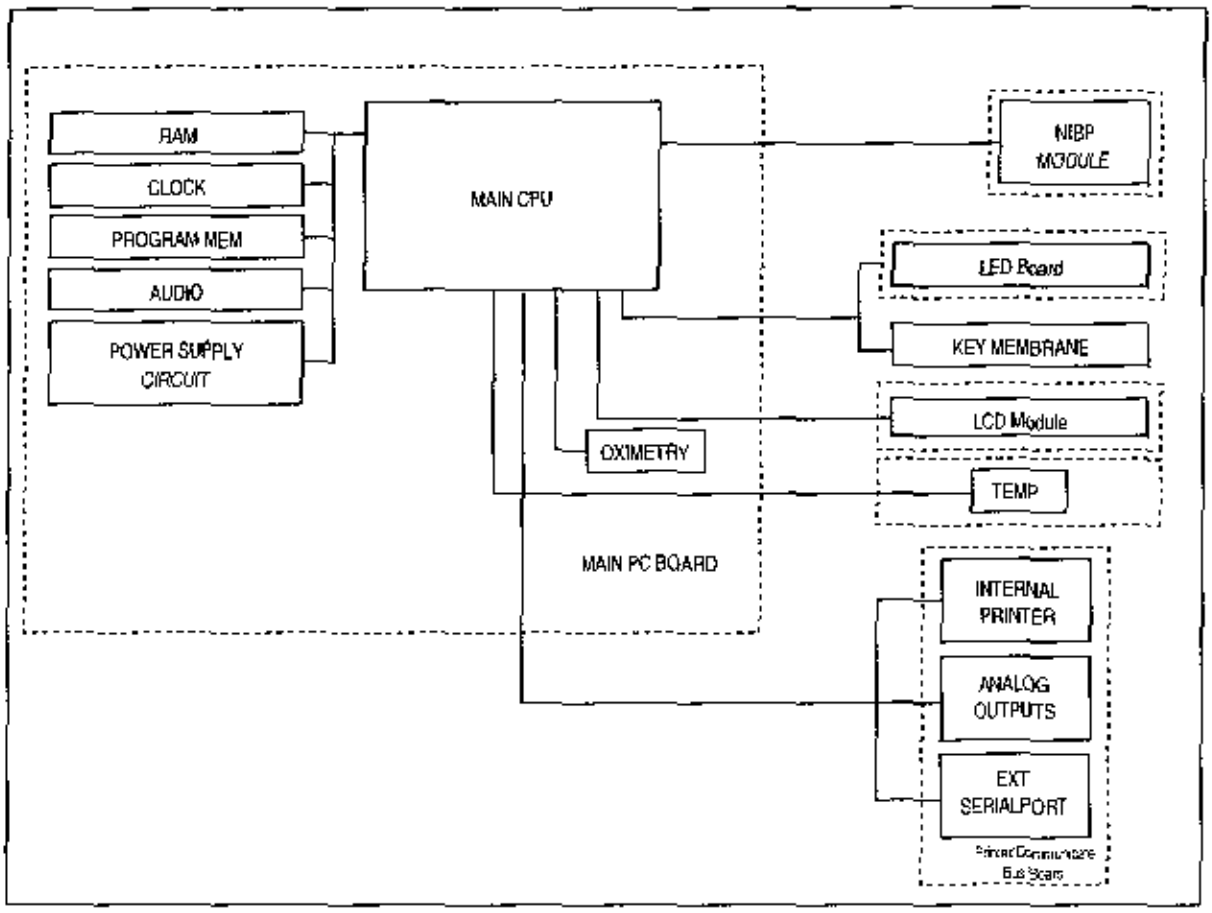



**Figure 3-3. 506DX2 Hardware Block Diagram.**

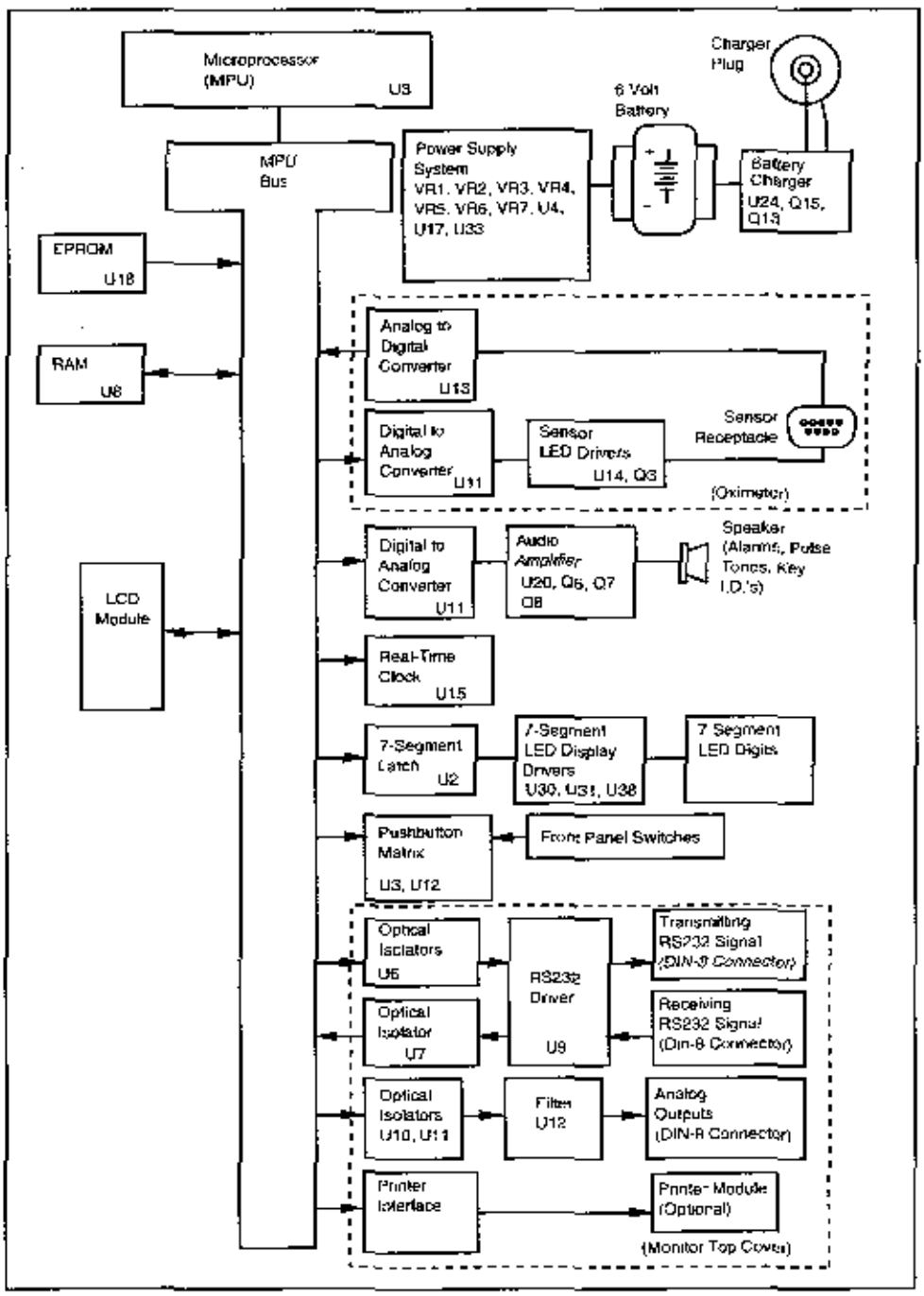



***Figure 3-4. Main/$SpO_2$ Board, Hardware and Circuit Block Diagram***

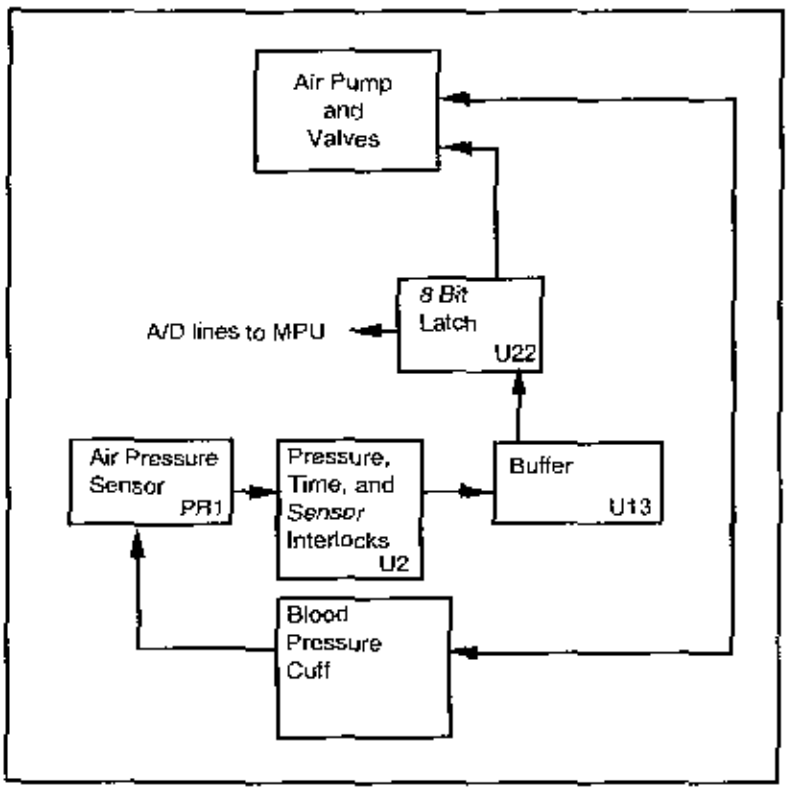



**Figure 3-5. Blood Pressure Board—Circuit and Hardware Block Diagram**

## Circuit Descriptions
## Main Circuit Board

### Power Supply

The power supply for the main board is derived from the battery or from the battery charger unit, if it is connected to the monitor. The charger provides approximately 12 - 16V DC, and can supply a peak inrush current exceeding 9 amps at start up. It can provide up to 1.6 amps continuous DC current. D27 and D18 are two diodes that allow the power sources to be connected to the power switching transistors Q16 and Q18 acting in parallel. The battery charger, if connected, has the higher voltage that gets connected through D27. In this case, battery is disabled by D18 acting in reverse bias mode. However, if the battery charger is removed or if the mains power turns off, then D18 gets a forward bias and takes over for a smooth transition. For high-load conditions, both the battery charger and the battery may be active for a short period, if the circuit voltage drops below the battery voltage by 0.6 V, +BATT the alarm will appear.

### Battery Charger Circuit

The circuit elements are D9-D12, Fuse F2, Q13, Q15 and U24 with its associated control elements. The charger U24 is enabled whenever Q15 is turned on, allowing a ground connection to U24 pin 6 and also to R69 and C55. This happens if a charger voltage is available at the power input connector.

Charger IC U24, senses the current through R77, R78, and the battery voltage to suitably adjust the current through Q13. The battery charger has two modes. One is the bulk current charging, which can be up to 670 mA, when battery level is low. The second mode is the trickle charge mode where the battery level is close to fully charged condition and the current drops to a trickle of a few milliamps. Fuse F1 protects the battery from excessive currents and shorts at the load point.

### Power On indicator

Connecting the battery charger to the power input turns on the green LED at the front panel indicator via the signal path CG LED connected to test point TP8 through R75. Thus the green LED at the front panel indicates that the battery charger is active and connected, but is not a direct indication that the battery is being charged.

### ON/OFF

The monitor is turned on/off by the front panel power control switch. This circuit consists of U7 and a flip-flop U5 that can store the on/off status. This part of the circuit requires a +5 volts supply all the time and is derived from the voltage used for keeping the trend data nonvolatile. This is the +5B supply derived directly from +BATT through U26 at test point TP15.

**Low Battery Detector and Watchdog Circuit**

The monitor can be turned off automatically under two conditions. The first case occurs when the CPU does not continue to provide a watchdog pulse for more than 1.6 seconds. For this condition, the watchdog U6 pulls pin 8 low so that flip-flop U5 is cleared. This causes the monitor to shut off by switching off transistor Q16. The second case occurs when the monitor operates from the battery without the charger plugged in, and the battery voltage goes low below 5.6 Volts. For this condition U6 detects the power failure and pulls down the voltage at pin 5. so that U5 is cleared and Q16 is switched off.

5Va Analog Supply

U25 is low-drop linear regulator providing +5 volts for operating U13 (TP14). The -5 volts at TP16 also is meant for operating U13.

5Vd Digital Supply

All digital circuits are operated from this supply, which is derived from U2, a low-drop linear regulator.

Isolated Supply for Serial Interface

The analog output and central station serial interface circuitry operates on an isolated power supply of +/- 5V derived through magnetic coupling across the isolation barrier. Transformer T1 is operated from a +5D supply and switched at approximately 160 kHz by transistor Q1 whose gate is controlled by an oscillator circuit formed by U8, R5, R19, and C5. D2 is a clamping zener diode for clamping reverse spike voltages due to switching. D1 and C15 forms half-wave rectifier element to provide unregulated supply voltage. Regulator U5 provides a low-drop +5 volts output.

Microcontroller

Microcontroller U3 is a microcontroller which can be configured for different address, data, and input/output states. It has internal timers that can be configured as free-running timers or as counters. This microcontroller is hardware-configured for mode 1 at pins *MD0*, *MD1*, and *MD2*, which means it can access up to 1 MB address space and 8-bit data elements, and is configured by the software to select blocks of 128 Kb address space through signal pins CS0 to CS7. These pins come as input pins (excepting CS0), prior to getting programmed as chip selects, so that pull-up resistors are provided for power-up state or reset states.

Port 4 is configured on power up as an output port for controlling finger sensor LEDs (RGATE, IRGATE), and DDC101 (U13). Other signal pins on port 4 are connected to U13 for initializing and controlling U13 along with pin 2 which is programmed to output a burst of 21 DMA clocks for every sample converted by U13, for reading out the data serially via U10. U10 is a serial shift register clocked by the DCLK signal and read out by the /RDOXY signal decoded via U1. U1 and U9 are decoders that allow all relevant operations to be read as memory locations. These include, LCD, 7-segment LED controllers, oximeter sensor LED current level DAC, real-time clock control, printer motor control, and audio volume control

U18 is a flash EPROM of 256K KB capacity. It can be written into through the use of necessary software after activating the MFLASH control signal connected to U3 pin 67. U8 is a SRAM of capacity 128K and is nonvolatile, being backed up by a +5B volts derived from battery via U26. This stores all system configurations previously selected. All trend data collected is also stored here until erased by menu control. The data contents are lost upon removal of battery connections to the main board.

**RTC Operation** Real-time clock operation is supported by U15 and operates on +5B trend memory voltage for nonvolatile operation. Once initialized, accurate time and calendar information is maintained by crystal controlled operation of U15. All data are read/written via data bus with the help of DS (data strobe) and AS (address strobe) signals available at U9 decoder. All data is initialized at the start up. All timer data is lost if the battery connection is removed, and will need to be manually entered again on power up.

**LCD Contrast** U19, U23 and associated components form the LCD contrast control elements and the contrast level is controlled by U3 pins 19 and 12 named as signals CONCS and CONU/D respectively. U11 is a digital potentiometer, having memory for the previous set up, which is loaded from U3 control initiated from software menu control. The setting allows control over current flow through R63 and consequently over the contrast voltage at the output of U23. Voltage can be varied between 0-2.5V to obtain optimum contrast on the LCD display. Connector J3 pin 3 connects the signal to the LCD module.

**LED Operation** All numeric data displayed on the front panel 7-segment LEDs (e.g., heart rate, pulse rate and blood pressure systolic, diastolic and mean values) are controlled by U2, U31 and U38 under the supervision of U31 and hardwired to the display board via the J12 and J4 connector. Decoder U1 loads the data to be displayed first into the latch U2 and transfers the same to one of the LED controller ICs, U30, U31, or U38. The data contains relevant information for displaying the digit position and the numeric value. The digits that are altered by U3, are displayed by U30, U31, and U38 at a rate that avoids flickering .

**Speaker Volume/** U11, U20B, Q6, and Q8 with associated elements form the audio

### Tone Control

volume control. U11 is a dual DAC that is loaded with volume level data via the data bus by U3 using decoder U1. When the speaker is activated, the amplitude of current through the speaker is controlled by the DAC via Q8 and Q6. The tone generated by the speaker is controlled by U34 pin 4 which is programmed to output a PWM signal using its internal timer characteristics. The tone frequency therefore can be set by the software on the fly to generate tones for beat rate, pulse rate or alarm tones of various frequencies to conform to the requirements. The speaker is turned on/off at this tone frequency while the volume level is controlled by Q8 current pumping.

### $SpO_2$ Section

The $SpO_2$ is measured using Criticare's Digital Oximetry™. This circuit design is proprietary to Criticare Systems, Inc.

### Oximeter Instrumentation

U13 is a sigma delta converter at the heart of oximeter instrumentation. It is a charge digitizing IC with 20-bit resolution that is connected to the photosensor for oximetry operation. The unipolar input to U13 is generated by the photodetector part of the finger sensor. Its parameters are initialized by the microcontroller for optimum oversampling frequency and digital filtering to reduce system noise. It is operated in non-continuous mode for acquiring pulsed oximeter data. The rate of acquisition limits the data bandwidth. It outputs a 21-bit serial bit data under the timing control of U3. Resistors R37 and R38 allow proper current limiting to realize the range of signal input not exceeding 0.5 uA and 500 millivolts full scale. U4 provides a 2 MHz clock for operating U30. U32 allows synchronizing the clock for a start of data operation via the /FDS signal, which is initiated by U3 signal / FDSST at pin 107, programmed as a timer pulse operating at the data sample rate.

Every time the data conversion is over and /DVALID signal becomes available at U13 pin 15, the data overflow error information is stored in U12 and interrupt is created on pin 25 of U3 programmed to receive the IRQ5 interrupt. This interrupt internally initializes its timers to output a burst of 21 clocks in DMA fashion via signal DCLK pin 2. This clock allows U30 to output a series of 21 data bits serially into U10, a serial-in, parallel-out register. The data from U10 is read by the DMA operation into 21 locations of the memory to collect all the data for further processing.

## Temp. PCB assembly

The 506DX2 Temperature PCB assembly has one funtional block. A description of the Temp function follows.

### Overview

The power supply for the entire temperature operation is derived from the supply available on the motherboard of the 506DX2 unit.

### NIBP Board

The 506DX2 NIBP module contains all necessary electronics to allow the main board to control and take non-invasive blood pressure readings. The NIBP board contains the following:

- NIBP cuff interface (pneumatic connection).
- Cuff pressure detection, amplification and filtering.
- Inflation/deflation control including pump and valve control.
- Overpressure protection electronics.
- *Extended duration overpressure protection electronics.*

### Temperature Module

The 506DX2 temperature module uses a thermistor in the tip of the probe to sense heat. This causes a change in the resistance of the thermistor (inverse and non-linear). The thermistor is part of a resistive voltage divider that feeds into one of the multiplexed inputs of the A/D converter U1. The resistive divider consists of R4 and the probe. D1 and D2 protect the input of the A/D from ESD damage. The temperature probe has a loopback wire on its plug going from pins 2 to 5. By monitoring the PREDICT signal, the processor can determine when a probe is inserted. S1 is used to indicate to the processor when the probe is inserted into the probe well.

U1 is a 20 bit sigma-delta A/D converter with built in calibration and signal conditioning circuitry. Each time the probe is plugged into the unit, the microprocessor issues a command to recalibrate the A/D. The timing of U1 is driven by a 10 MHz clock (ADC_CLK), which is generated by processor U3 on the main board. The microprocessor communicates with U1 over a synchronous serial bus, consisting of RX0 (output of A/D), TXO *(input to A/D), and TCLK (serial clock).* When a conversion is complete, the A/D responds by driving DRDY low. DRDY going low generates an interrupt to the microprocessor. U1 generates its own reference voltage +2.5 REF. U2, U3, and digital sections of U1 are powered by +5D, which is generated on the main board. L1, C13, C14, and C15 are used to filter the supply for the analog portions of the circuitry.

# Section 4 — Testing

## 1. Purpose

The purpose of this procedure is to provide a method of testing the 506DX2 monitor.

## 2. Associated Material

| | Instrument | Recommended Characteristics | Recommended Model |
|---|---|---|---|
| 1. | Digital Multi-Meter | 4½ Digit | Fluke # 8060A |
| 2. | Test Finger Sensor | | Cat. No. 511-10L |
| 3. | Hypot Tester | 4000 VAC max. | Kikusui TOS 8700 |
| 4. | Capacitor | 2200 picofarad | CSI P/N 20004B019 |
| 5. | Power Adapter/Charger | | Cat. No. 908 |
| 6. | $SpO_2$ Simulator | | Cat. No. 913AD |
| 7. | 700 cc Dummy Cuff | | CSI P/N 95513A001 |
| 8. | Manometer | | Seba or equiv. |
| 9. | NIBP Simulator | | Dynatech Cufflink |
| 10. | Barrel, Lemo Connector | | CSI P/N 40009B001 |
| 11. | Variable Power Supply | 10-15VDC/50amp | Heath or equiv. |
| 12. | Power Test Cable | | Fabricate - See Sect. 4 |
| 13. | Leakage Tester | | Dyna Tech Model 232 or equiv. |
| 14. | Battery load simulator cable | Fabricate - See Sect. 4 | |
| 15. | Probe Simulator | | ALARIS Cat. No. 193737 |
| 16. | Frequency Counter | | B and K or equiv. |
| 17. | Oscilloscope | | 100MHz or better Tektronics or equiv. |
| 18. | Temp Probe | | Cat. No. 444 |

**3. Follow manufacturers procedures when using test equipment.**

## LEAKAGE PERFORMANCE

4.0 When using the Dynatech 232D, perform the selftest on the unit. If the self test fails, don't proceed with this test.

a. The cover should stay on for the leakage tests. Perform a self test on the Dynatech 232D. Turn on the unit. Set the MODE switch to SELF test. The display should read 1000 +/- 20 and the CURRENT SOURCE ACTIVE lamp should be on. Caution, if these conditions are not met, do not continue with the leakage test.

b. Set the MODE switch on the Dynatech to L1-L2. The display should read 110 to 130 VAC. Set the MODE switch to L1-GND. The display should read no more than 5% of the previous line voltage measurement. Set the MODE switch to L2-GND. This reading should be the same as the first reading, +/- 5 VAC.

4.1 Set the MODE switch to CASE LEAKAGE/GROUND CONDUCTOR. Perform the following leakage steps.
4.2 Normal Polarity (<50uA)
4.3 Reverse Polarity (<50uA)
4.4 Normal Polarity, Open Neutral (<50uA)
4.5 Reverse Polarity, Open Neutral (<50uA)
4.6 Normal Polarity, Open Ground (<50uA)
4.7 Reverse Polarity, Open Ground (<50uA)
4.8 Set the MODE switch to ECG to GROUND and the LEADS switch to ALL.
4.9 SPO2 leakage (<10 uA)

**NOTE**

- Ground Resistance is not required for this instrument.

**COMPUTER SPO2 SIMULATOR PERFORMANCE**

4.10 Verify the EUT operates correctly with the computer O2 Sat/Pulse simulator. The heart rate should read 180 +/- 3 bpm. If the unit fails only one level, rerun and pass the unit if it passes the second time.

| Level | Saturation(%) | Limits(%) |
|---|---|---|
| 1 | 99 | 97 - 99 |
| 2 | 96 | 94 - 98 |
| 3 | 90 | 88 - 92 |
| 4 | 78 | 76 - 80 |
| 5 | 61 | 58 - 64 |
| 6 | 52 | 49 - 55 |
| 7 | 40 | 37 - 43 |

***POWER SUPPLY PERFORMANCE***

4.11 Verify the current draw is less than 200 uA when the EUT is "off".

4.12 Verify the current EUT draw is less than 500 mA at a +6.5VDC input voltage while running without the NIBP pump running.

4.13 Verify the green AC LED lights up a AC power symbol on the front membrane when a CAT. 908 or CAT. 905 charger is plugged into the AC connector.

4.14 Verify the EUT powers up on AC only with a Cat. 141886 charger.

4.15 Verify the EUT powers up on DC only with a +6.5VDC input voltage.

4.16 Turn voltage down to (5.9vdc) to Verify a yellow LED flashes on and off, lighting up the low battery symbol on the front membrane.

4.17 Turn RT1 clockwise all the way. Turn voltage down to 5.53vdc. Turn RT1 counterclockwise until unit shuts off.

4.18 Verify the Bulk charge is 660mA +/- 5%, by inserting an amp meter in series with a fully drained battery.

4.19 Verify the float or trickle charge is less than 100mA by inserting an amp meter is series with a fully charged battery.

**SPO2 PERFORMANCE**

4.20 Verify "SPO2: NO SENSOR" message is displayed when there is nothing connected to the SPO2 connector.

4.21 Verify "SPO2 : SENSOR" message is displayed when the finger sensor is plugged in, but with no finger inserted in the sensor.

4.22 Verify "SPO2: HIGH AMBIENT" message appears by introducing a higher than normal amount of ambient light on the SPO2 sensor detector.

4.23 Using a SPO2 finger sensor, verify heart rate and plythesmograph operation displayed on the LED's within 15 seconds. Verify no SPO2 error messages appear (alarm violations may occur depending on individual readings and monitor set-up).

**SPEAKER PERFORMANCE**

4.24 Verify the speaker produces audible alarm tones that can be adjusted via the software.

4.25 Verify that analog channels A and B are set to "TEST MODE". Adjust RT2 so U12.1 is 1.000VDC +/- .005VDC and adjust RT3 so U12.7 is 1.000VDC +/- .005VDC.

4.26 Check U8.4 for clock signal of 100Khz ± 10%.

4.27 Verify the 10-segment green LED bar graph displays the relative strength of the pulse by lighting a proportional number of LED segments.

4.28 Verify a red LED lights up the sensor signal symbol on the front membrane when sensor and signal conditions are present.

4.29 Using an optical load to simulate a small signal, verify "SPO2: SEARCH" appears after search delay time +/- 5 seconds. (an optical load that can be used for this test is a foam peanut used for packing)

## TEMPERATURE PERFORMANCE

4.30 *Verify* "TEMP: NO PROBE" message is displayed when there is nothing connected to the temperature input connector.

4.31 Verify the EUT displays the correct temperature in MONITOR mode using the temperature simulator.

| **Simulator Setting** | **Thermometer Reading** |
|---|---|
| *80.2* | 80.2 +/- 0.2°F (26.7 +/- 0.1°C) |
| 98.0 | 98.0 +/- 0.2°F (36.7 +/- 0.1°C) |
| 98.6 | 98.6 +/- 0.2°F (37.0 +/- 0.1°C) |
| *102.0* | *102.0* +/- 0.2°F (38.9 +/- 0.1°C) |
| 107.8 | 107.8 +/- 0.2°F (42.1 +/- 0.1°C) |
| B.P. | 106.0 +/- 0.2°F (41.1 +/- 0.1°C) |

4.32 Verify "TEMP: "BAD PROBE" message is displayed when the probe temperature exceeds 107.9°F, (42.1°C). Press Broken Probe button on the simulator when the dial is set for BP.

4.33 Verify a predictive reading can be achieved while in NORMAL (predictive) mode by taking an oral temperature reading. *Refer to operating manual for further* instructions.

4.34 Verify that analog channels A and B are set to "TEST MODE". Adjust RT2 so U12.1is 1.000VDC +/- .005VDC and adjust RT3 so U12.7 is 1.000VDC +/- .005VDC.

4.35 *Check U8.4 for clock signal of 100Khz ± 10%.*

## PRINTER PERFORMANCE

4.36 Verify Data is printed.

4.37 If Printer density is not dark enough, adjust it using RT1 on the printer board when using battery power.

## NIBP CALIBRATION

4.38 With the power turned off, remove rear cover of the unit to be calibrated.

4.39 Connect the 9 pin DIN serial cable from the unit to the serial port of the PC.

4.40 Start the NIBP Service program and enter the initials of the service technician.

4.41 Power up the unit while pressing the START/NIBP/ STAT/STOP key.

4.42 On the display of the unit, verify that the message "Checking for Service Tools" appears.

4.43 Verify that the message "Service Tools in Progress" appears. When this message appears, communication with the PC has been established.

4.44 Observe the computer link. When communication is established, the message "STATUS(LOW or NEG)" will appear to the right of "LAST MSG RECV".

4.45 Pressure calibration

- 4.45.1 Press F9 to calibrate NIBP. Computer should display "FACTORY CAL" to the right of "LAST MSG SENT".
- 4.45.2 Adjust R1 to display 0 cuff pressure. Computer displays "CUFF: 0".
- 4.45.3 Connect manometer and 700cc reservoir to the NIBP Test Fixture.
- 4.45.4 Press space key to activate pump.
- 4.45.5 Adjust RV1 until the display on the computer is equal to the actual pressure displayed on the manometer 6.5 mmHg.
- 4.45.6 Press the space key.

4.45.7 Press F9 key and readjust R1 as needed to 0V if more than 6.5 mmHg.

4.45.8 If readjustment is needed for R1, repeat steps 4.45.2 through 4.45.7 until no more adjustment is required.

4.45.9 Turn off the unit being tested.

***NIBP PERFORMANCE***

4.46 Verify inflate time is 12 to 15 seconds.

4.47 Verify the maximum deflate time using a 700cc dummy cuff is 14 seconds ± 4 seconds.

4.48 Verify that the NIBP leakage rate is less than 4.0 mm Hg per minute using the Dynatech leakage tester.

4.49 Monitor U23.7 with voltmeter and adjust R143 for 1.00V. Turn unit on. Press start button to actuate pump. Monitor U23.7 for 1.00V, while pump is running.

4.50 Connect EUT to a Dynatech Nevada NIBP simulator and set it for 120/80 operation. Press the START/ NIBP/STAT/STOP key. The EUT should take a NIBP reading. The systolic and diastolic readings should appear on the LCD within +/-5 mm Hg of the setting on the simulator, which ever is greater. Recalibrate EUT if needed.

4.51 Set the EUT to take NIBP readings at 1 minute intervals. Verify the reading are accurate (+/- 5 mmHg ) and that they occur at 1 minute intervals +/- 5 seconds.

4.52 Verify STAT mode operation by holding the START/ NIBP/STAT/STOP key for 2 seconds.

4.53 Connect EUT to a Dynatech Nevada NIBP simulator and set it for 80/50 operation. Set the EUT up into neonate mode. Press the START/NIBP/STAT/STOP key the EUT should take a NIBP reading. The systolic and diastolic readings should appear on the LED's within a ± 5mm Hg or of the setting on the simulator which ever is greater. Also check for green LED on the front membrane signifying neonate mode.

4.54 Recalibrate the NIBP if readings exceed limits 120/8 or 80/50 ± 5mmHg. Check review screen.

4.55 ASSEMBLY OF THE UNIT

4.55.1 Glypt pots, RTV valve and pump connector

on NIBP.

4.55.2 Ensure that all connectors are secure and locked.

4.55.3 Ensure that all fasteners are in place and secure.

4.55.4 Ensure that the internal pneumatics are correctly routed and secured.

4.55.5 Ensure all internal wiring is correctly routed and secured.

4.55.6 Ensure that all external surfaces are free from defects, scratches, and marks.

4.55.7 Place unit on its face and put printer bottom on top. Screw down with (2) screws to hold unit together. Place final test sticker inside towards bottom of the bezel.

**MANUAL MODE PERFORMANCE (when the RECALL MENORY key is pressed and held during POWER UP..)**

4.56 Verify a red LED lights up the alarm silence indicator on the front membrane when the alarm silence key is pressed. After a 2 minute period, the red LED will go off and any current alarms will reactivate. If the alarm silence key is pressed and held down for 2 seconds, the red LED will flash continuously and all alarms will be silenced. Also check for Audio Off operation.

4.57 Verify while in MANUAL MODE, the following changes shall occur:

1. The ALARM menu shall not be active.
2. The NIBP cycle time menu shall not be active.
3. The following CONFIGURATION SETUP items will not be active: TIME; hour, min, day Serial, analog A/B, Language, trend interval.

4.58 Verify while in Manual MODE , the following shall be active:

1. PARAMETER SETUP: Mode adult/neo, pulse vol, SPO2, Search,SPO2 Average, NIBP, NIBP Tone, F/C, Contrast.

4.59 Verify all memory entries taken while in MANUAL MODE will be erased upon power cycling.

**TREND**

4.60 Verify the value of each parameter, along with alarm *conditions, is* stored at the zero seconds mark on the printout by holding the print key for 2 seconds after valid data is stored.

4.61 Verify that the trend information is printed out.

**FACTORY SERVICE SCREEN**

4.62 Verify the built-in factory service tests by holding the down arrow on power up with no upgrade tool attached to the external serial port. Verify serial number.

1. Perform LED Test by cycling through with the up arrow until LED appears then press menu to perform test.
2. Printer test.
3. Printer feed test.

**LOCKED MENU ITEMS**

4.63 Verify the LANGUAGE/Line Frequency menu items are *normally locked; they are* only unlocked for the duration of the power cycle following a configuration data reset.

**MISC. PERFORMANCE**

4.64 *Verify the LCD contrast can be adjusted via software* located in the Configuration Menu.

4.65 Set time, Date, to current located in Configuration Menu.

***EXTERNAL COMMUNICATION PERFORMANCE***

4.66 Verify software down-load port (J1 on the Printer Board) operates correctly. Connect the EUT (J1 on the printer board 91308A001) to a computer that has the current software and the downloading program.

4.66.1 At the C:< prompt, type menu to enter the manufacturing menu.

4.66.2 Select either "C)506dxntp v2.0 download or "D) 506dxntpv v2.0 ivac dl".

4.66.3 Read and follow the instructions on the PC monitor.

4.66.4 Press "Alt-C on the keyboard to open the port. Wait for the downloading loader ...xxx% to count from 0% to 100%.

4.66.5 Press the tab key to move the cursor to the new serial number entry line. Enter the serial number of the unit on this line and press the tab key until the cursor is at the "Alt -S. Send board ID info" entry line. Press "Alt-S" on the keyboard to send the serial number. The PC monitor should read "transmitting serial number".

4.66.6 Press Alt-D on the keyboard to start down loading the new software. The PC monitor should read "Downloading indication ....xxxx % and will count up to 100 %. The unit will then reboot upon completion of the download. Wait for the reboot and then check the software revision and checksum on the unit.

4.67 Verify the EUT communicates via the external serial port (J1 on the printer board)with the Vital View central station using the CUSP format when unit is being shipped with a Vital View system.

4.68 Place the Tested Unit on the 48 Hour Run Rack.

Unit serial number _____

Software Rev. _____ ... _____

Tested by _____

Date _____

| | | PASS | FAIL |
|---|---|---|---|
| 6.10 | HiPot SPO2 Ground to case @ 1500VAC | _____ | _____ |
| 6.11 | Dynatech Self Test | _____ | _____ |
| 6.13 | Leakage Normal Polarity (<50uA) | _____ | _____ |
| 6.14 | Leakage Reverse Polarity (<50uA) | _____ | _____ |
| 6.15 | Normal Polarity, Open Neutral (<50uA) | _____ | _____ |
| 6.16 | Reverse Polarity, Open Neutral(<50uA) | _____ | _____ |
| 6.17 | Normal Polarity, Open Ground (<50uA) | _____ | _____ |
| 6.18 | Reverse Polarity, Open Ground(<50uA) | _____ | _____ |
| 6.20 | SPO2 Leakage (<10uA) | _____ | _____ |
| 6.21 | Verify EUT operates w/02 Sat/Pulse simulator | _____ | _____ |
| 6.22 | Measure Quiescent Current. (<.200 uA) | _____ | _____ |
| 6.23 | Measure Current Draw (<500ma) | _____ | _____ |
| 6.24 | Verify Green Charge LED w/AC connected | _____ | _____ |
| 6.25 | Verify unit powers up with Cat 908. | _____ | _____ |
| 6.26 | Verify unit powers up @ 6.5VDC. | _____ | _____ |
| 6.27 | Verify Low Battery LED. (5.9VDC +/- .1VDC) | _____VDC | _____VDC |
| 6.28 | Verify Unit Shut down. (5.53VDC +/- .1VDC) | _____VDC | _____VDC |
| 6.29 | Verify Bulk Charge is 660mA ± 5% | _____mA | _____mA |
| 6.30 | Verify trickle charge < 100mA | _____ | _____ |
| 6.31 | Verify "SPO2: NO SENSOR" condition | _____ | _____ |
| 6.32 | Verify "SPO2: SENSOR" condition | _____ | _____ |
| 6.33 | Verify "SPO2: HIGH AMBIENT" condition | _____ | _____ |
| 6.34 | Take SPO2 & HR readings | _____ | _____ |
| 6.35 | Verify Speaker operation | _____ | _____ |
| 6.36 | Verify Analog Ch A & B set | _____VDC | _____VDC |
| 6.37 | Check U8.4 for clock 100Khz ± 10% | _____ | _____ |
| 6.38 | Verify LED Bargraph operation | _____ | _____ |
| 6.39 | Verify Red LED Sensor Symbol | _____ | _____ |
| 6.40 | Verify "SPO2: SEARCH" condition | _____ | _____ |
| 6.41 | Verify real time & interval print outs | _____ | _____ |
| 6.42 | Verify printer density | _____ | _____ |
| 6.43 | Verify "TEMP: NO PROBE" condition | _____ | _____ |
| 6.44 | Verify "TEMP ERROR" message | _____ | _____ |
| 6.45 | Verify Temperature Simulator readings | _____ | _____ |
| 6.46 | Verify "TEMP: INVALID" condition | _____ | _____ |
| 6.47 | Verify predictive reading | _____ | _____ |
| 6.48 | Verify Analog Ch A & B set | _____ VDC | _____VDC |
| 6.49 | Check U8.4 for clock 100Khz ± 10% | _____ | _____ |

| | | | Pass | | Fail |
|---|---|---|---|---|---|
| | 6.50.2 | NIBP Calibration 0 ± .5 mmHg | _____ | | _____ |
| | 6.50.5 | High end actual pressure ± .5 mmHg | _____ | | _____ |
| | 6.51 | Speed Test | _____ | | _____ |
| | 6.52 | Deflate Test | _____ | | _____ |
| | 6.53 | Perform Leak Test | _____ | | _____ |
| | 6.54 | Verify 1.00v on U23.7 during power on. | _____VDC | | ___ .VDC |
| | 6.55 | Verify 120/80 @ NIBP Simulator | _____ | | _____ |
| | 6.56 | Verify (1Minute) NIBP readings | _____ | | _____ |
| | 6.57 | Verify Start/Stat/Stop operation | _____ | | _____ |
| | 6.58 | Verify Neonate mode, 80/50 @ NIBP Simulator | _____ | | _____ |
| | 6.59 | Verify NIBP Cal | _____ | | _____ |
| | 6.60 | Mechanical Inspection | _____ | | _____ |
| | 6.61 | Verify Red LED Alarm Silence indicator | _____ | | _____ |
| | 6.62 | GLYPT all pots | _____ | | _____ |
| | 6.63 | Verify Manual Mode | _____ | | _____ |
| | 6.64 | Verify active parameters | _____ | _____ | |
| 6.65 | Verify Data is erased upon power up | | _____ | _____ | |
| | 6.66 | Verify Trend | _____ | | _____ |
| | 6.67 | Verify Trend Printing | _____ | | _____ |
| | 6.68 | Verify Factory Service Screen | _____ | | _____ |
| | 6.69 | Perform LED test. | _____ | | _____ |
| | 6.70 | Verify Language/Line Frequency Screen | _____ | | _____ |
| | 6.71 | Verify LCD Contrast | _____ | | _____ |
| | 6.72 | Set time, Date | _____ | | _____ |
| | 6.73 | Verify Down Load Port | _____ | | _____ |
| | 6.74 | Verify ext serial port/link with VV | _____ | | _____ |
| | 6.75 | Place tested unit on 48 Hr run rack | _____ | | _____ |

CERTIFICATION THAT THE UNIT IS CALIBRATED AND FUNCTIONING PROPERLY.
NAME _____DATE_____
COMMENTS _____

48 HOUR RUN: DATE ON_____ TIME_____
CERTIFICATION THAT THE UNIT IS CALIBRATED AND FUNCTIONING PROPERLY.
NAME _____DATE_____
COMMENTS_____
_____

# Section 5 — Calibration and Periodic Maintenance

**Calibration** No calibration is necessary for the 506DX2 monitor.

**Maintenance Schedule**

| | |
|---|---|
| Every Patient | • Replace all the temperature sensors.<br>• Clean the pulse oximeter sensor (unless it is a disposable sensor). |
| Every Day | • Inspect the NIBP cuff hose for proper connection and kinks. Clean as needed. |
| Every Month | • Inspect pulse oximeter sensors and cables for damage. |
| Every 3 Months | • Clean the exterior of the unit (or clean as needed). |
| Every Year | • Perform the annual safety tests described in this section. |

## Annual Safety Tests

The monitor should be electrically tested annually as follows–

**⚠ CAUTION ⚠**

- Remove the main battery before performing any service, testing, or maintenance procedures.

**NOTE**

- Safety tests should be performed only by CSI-authorized service technicians.

### Leakage Current Testing

Leakage current testing is described in **Section 4 – Testing**.

### Cable Testing

Patient cables (SpO2. and temperature) and other cables (power cord, etc.) should be checked periodically for damage, loose wires/connections, loose connectors, cracked housing, etc.

### System Testing

The 506DX2 monitor has buiH-in system tests which should be performed regularly. However, the tests should be performed by ***qualified service personne/ only***. Contact Criticare Systems Technical Services at 1-00 458-2697 for additional information.

**⚠ WARNING ⚠**

- If the unit fails any tests, contact CSI Technical Services. DO NOT use the monitor for patient monitoring until the problem is fixed.

## Long-Term Storage

The monitor will be unused for longer than 30 days, perform the battery removal procedure described in **Section 7 – Disassembly**, and store the battery in a safe place. Be sure to note the environmental storage limits listed in **Section – 2 Specifications**.

When the monitor is returned to service, perform the battery replacement procedure described in **Section 7 – Disassembly**.

## Service Checks

If the monitor shows any signs of physical damage, return it to the CSI Service Department for repair.

Have a qualified service technician perform the following performance and safety checks annually.

- Perform complete functional testing of the monitor as *described in the test* procedures in the 506DX2 Service Manual.
- Test the monitor for electrical leakage as described previously in this section.

***NOTE***

- No user-serviceable parts exist inside the monitor. Do not remove the cover. Refer all servicing to a qualified technician.

## Calibration

No peridic calibration of the NIBP module is required.

Calibration of the NIBP module is required when any component within the module is removed, replaced, or serviced.

## Purpose

The purpose of this procedure is to provide a method of calibrating of the CSI NIBP Module while attached to the final assembly.

## Responsibility

It is the responsibility of the technician performing the testing and calibration to follow the steps outlined in this procedure.

## Application

Applies to the 506DX2 units containing the NIBP Module AY 95541A002 that are manufactured by CSI.

1.0 Definition: N/A.

2.0 Associated Material:

Manometer

700 cc Factory Test Block, tee & tubing

506DX2 Extender Cable

*9 pin Download Cable*

IBM PC or Compatible 386 or better with 9 pin S232Serial Port

## NIBP Service Program

### Procedure

3.1 With the power turned off, remove rear cover of the unit to be calibrated.

3.2 Remove the NIBP module from the unit.

*3.3 Connect the 506DX2 Extender cable from the NIBP* module to the main board.

3.4 Connect the 9 pin DIN serial cable from the unit to the serial port of the PC.

3.5 Start the NIBP Service program and enter the initials of the service technician.

3.6 Power up the unit while pressing the START/STAT/STOP key.

3.7 On the display of the unit, verify that the message "Checking for Service Tools" appears.

3.8 Verify that the message "Service Tools in Progress" appears. When this message appears, communication with the PC has been established.

3.9 Observe the computer link. When communication is established, the message "STATUS(LOW or NEG)" will appear to the right of "LAST MSG RECV".

3.10 Pressure calibration

3.10.1 Press F9 to calibrate NIBP. Computer should display "FACTORY CAL" to the right of "LAST MSG SENT'

3.10.2 Adjust RI to display 0 cuff pressure. Computer displays "CUFF: 0".

3.10.3 Connect manometer and 700cc reservoir to the NIBP Test Fixture.

3.10.4 Press space key to activate pump.

# Section 6 — Cleaning and Disinfecting

This section describes cleaning and disinfecting procedures for the 506DX2 monitor and its accessories.

## Cleaning and Disinfecting

**⚠ WARNING ⚠**

- Turn the power off before cleaning the monitor and $SpO_2$ sensor. Never immerse the monitor or sensor in liquids. Severe electrical shock could result.

**⚠ CAUTIONS ⚠**

- Do not use abrasive cleaners on the monitor or on any sensors or probes. Abrasive cleaners can damage the monitor, sensors, and probes.

### Exterior Surfaces

The exterior surface of the 506DX2 monitor may be wiped clean with alcohol and dried with a soft dry cloth. A 10% bleach solution can be used for sterilization.

### Display

To clean the display window, wipe it with a clean, soft, lint-free cloth sprayed with glass cleaner. DO NOT spray any cleaner or any other liquid directly on the display window.

**⚠ CAUTIONS ⚠**

- Do not use alcohol or abrasive cleaners to clean the display window. Use of these cleaners may damage the display window. Use ordinary glass cleaners only.
- Use only a soft, clean, lint-free cloth. Paper towels or tissues can scratch the display window.

## Cleaning and Disinfecting (cont.)

### Pulse Oximeter Sensors

**NOTE**

- Disposable sensors are not intended for reuse.

**FINGER SENSOR**
The finger sensor may be wiped clean with alcohol. The surface of the sensor LED's and photodetector may also be cleaned with alcohol. Dry the surface with a clean dry cloth.

**OR,**

If visible contamination is present, disinfect the sensor with 2% glutaraldehyde solution, 70% isopropyl solution, cold gas (e.g. ethylene oxide), or a bleach solution (10%, 1 part household bleach and 9 parts water).

**⚠ CAUTION ⚠**

- Do not immerse <u>any</u> Criticare pulse oximeter sensor connector in <u>any</u> liquid. Doing so may damage the connector.

Follow the directions below for each sensor:

**511-10L Finger Sensor (Cat. No. 511-10L)**
The **511-10L** finger sensor and cable can be wiped clean with alcohol or disinfected by wiping with a disinfectant as described previously.

**"Shell™" Finger Sensor (Cat. 934-10L)**
The Shell™ finger sensor can be taken apart for disinfecting as follows (it can be left intact for wiping clean with alcohol):

## Cleaning and Disinfecting (cont.)

Refer to Figure 6-1. With one hand, squeeze the two release tabs on the shell toward each other. Simultaneously pull the strain relief (the thickest part of the wire just outside of the shell) with the other hand. The sensor paddles will be exposed, and can now be placed with the cable in a disinfectant solution as described previously.

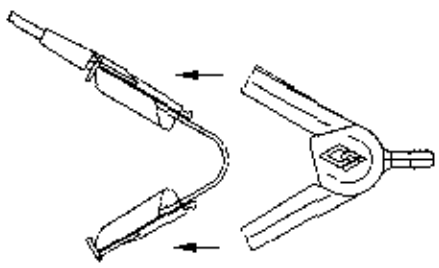


**Figure 6-1. Disassembling the Cat. No. 5354 Sensor.**

To reassemble, slide the paddles back into the shell until they snap into position (the paddle attached to the cable slides into the side of the shell with the finger drawing).

**Multi-Site™ Sensor (Cat. No. 517-10L or 940-10L)**
*The Multi-Site™ Sensor (Cat. No. 517-10L or 940-10L)* can be wiped clean with alcohol. The Multi-Site™ Sensor may be disinfected by placing the paddles and cable in a 2% glutaraldehyde solution. Place only the sensor paddles and cable in the solution.

## Blood Pressure Cuffs

The non-disposable blood pressure cuff may be cleaned by wiping it with a damp cloth or sponge. If necessary, the cuff may be disinfected by wiping with 70% alcohol, *10%* bleach solution, or other disinfectant. The cuff may be sterilized in an autoclave or with ethylene oxide (ETO). The cuff may also be laundered by hand or machine.

Be sure to observe the following precautions:

**⚠ CAUTION ⚠**

- Remove the latex bag from the cuff before laundering, disinfecting, or sterilizing the cuff.
- Strong bleach (greater than 10% solutions) will damage the cuff.
- Temperatures over 275° F (135° C) will damage the cuff.
- If the cuff is laundered, close the Velcro® fastener before laundering.
- Soaking the cuff in dark-colored solutions may stain or discolor the cuff.

Hand laundering (as opposed to machine laundering) will prolong the life of the cuff. Remove the latex inflation bag, then wash the cuff in warm, soapy water. Rinse the cuff thoroughly.

After cleaning the cuff, allow the cuff to air dry (as opposed to using a dryer), then insert the latex inflation bag in the cuff.

## Temperature Probes

For cleaning and disinfection procedures for reusable temperature probes, refer to the instructions that are shipped with each probe.

## Probe Covers

Disposable temperature probe covers are not reusable. Use a new disposable probe cover for each patient.

# Section 7 — Disassembly

## General Caution

Observe the following caution during all removal and installation procedures in this section.

**⚠ WARNING ⚠**

- Possible safety hazard. Read the battery safety information provided in **Section 1 -- Introduction.**

**⚠ CAUTIONS ⚠**

- Static-sensitive device! To prevent damage to the monitor, observe the following precautions:
  a. Perform the procedure on an antistatic mat
  b. Wear a wrist-grounding strap
  c. The wrist strap and mat should both be connected *through a resistor* (1 megohm typical) to a good earth ground
- Remove the main battery before performing any service, testing, or maintenance procedures.

## Back and Front Separation

### Back Removal

1. Follow the caution for static-sensitive devices on page 7-1.
2. Turn the monitor off.
3. Unscrew the two screws from the back of the unit as it sits on the table.
4. Pull the back half off being careful not to pull any wires.
5. Disconnect the battery cable from the main board at the connector on the main board.
6. Disconnect the printer ribbon cable from the printer/ communication board.

## Battery Replacement

### Battery Removal

1. Follow the caution for static-sensitive devices on page 7-1.
2. Verify that the unit is turned off and separate the back and front half as in the previous step.

**⚠ WARNING ⚠**

- The used battery is a potential environmental hazard and must be disposed of properly. Refer to the safety instructions in **Section 1 -- Introduction.**

3. Slide the ribbon cable out of the ferrite that is attached to the battery bracket.
4. Unscrew the two screws that are on the bottom of the unit and carefully rotate the battery bracket out of the metal back half enclosure. The battery is only temporarily supported by foam adhesive tape to the battery bracket.
5. Remove the battery assembly from the battery bracket.
6. Remove the battery cable from the battery.

### Battery Installation

1. Remove the battery from the unit, following the battery removal procedure in the preceding paragraphs.

**⚠ CAUTION ⚠**

- To avoid damaging the monitor, observe correct polarity when performing the next step.

2. Connect the battery cable to the new battery.
3. Slide the battery assembly into the battery bracket.
4. *Align the bracket and battery in the rear half of the* monitor. Secure the bracket on the bottom to the rear of the case.
5. Slide the ribbon cable through the ferrite prior to reinserting the ribbon cable and battery cable to the printer board and main board respectively.
6. Ensure that plastic screw guides are completely seated.
7. Secure the front and back halves of the monitor, making sure that NIBP cables are not pinched.
8. Secure the two screws through the back to the front bezel.

## Circuit Board Removal

## Temperature, NIBP, printer/communication, main/display boards.

1. Follow the caution for static-sensitive devices as on page 7-1.
2. Separate the front and back halves per instructions page 7-2.
3. Temperature board removal
   - 3.1.1 Remove the screw that holds the probe well to the temperature board.
   - 3.1.2 Carefully lift the temperature board up from the main board being careful not to damage the connectors of the adjacent NIBP board valves.
4. NIBP board removal
   - 4.1.1 Perform steps 1 through 3 to remove the temperature board.
   - 4.1.2 Using a 1/8" Allen wrench, remove the NIBP connector from the NIBP manifold. The nylon washer becomes loose when the connector is removed. Retain this part for reassembly.
   - 4.1.3 Carefully pull the flap of the protective insulator back and gently lift the NIBP board from the main board.
5. Printer/communication board removal
   - 5.1.1 Perform steps 1 and 2. Removal of the NIBP and temperature board are optional.
   - 5.1.2 Remove the 4-40 nylon screw, which holds the printer board to the main board.
   - 5.1.3 Carefully lift the printer/communication board from the main board being careful not to loosen or damage the pump tubing if the NIBP board is present.
6. Main/display board removal
   - 6.1.1 Perform steps 1 through 5.
   - 6.1.2 Carefully lay bezel assembly on face and remove the insulator from the unit.
   - 6.1.3 Remove one 4-40 x .375 screw and two 4-40 x.250 screws from the main board that holds the assembly to the bezel.

## Temperature, NIBP, printer/communication, main/display boards. (cont.)

7. LED removal

   7.1.1 With the main/display board removed from the unit, remove the four #2 self tapping screws that hold the LED board to the main board.

8. LCD removal

   8.1.1 With the main/display board removed from the unit, unsolder the header that mates the LCD board to the main board.

   8.1.2 Remove the four #2 self tapping screws that hold the LCD board to the main board.

## Printer Removal

1. Separate the back and front halves following the procedure on page 7-1.
2. Slide the ribbon cable out of the ferrite that is attached to the battery bracket.
3. Unscrew the two screws from the top of the back half while holding the printer enclosure. The enclosure will become free.
4. Once the enclosure becomes free, slide the locking connector back to remove the flex cable from the printer PCB assembly.
5. Remove the four screws that hold the printer interface PCB assembly and printer to the printer/paper enclosure bracket.

## Printer Installation

1. Follow the Final Assembly Procedure 93916A003 for the assembly and installation of the printer.

# Section 8 — Troubleshooting

This section lists the possible causes of monitor problems. Use these tables to identify and locate possible malfunctions.

| **Symptom** | **Problem** | ***Solution*** |
|---|---|---|
| Unit won't power up | • Battery is discharged<br>• AC charger is not securely connected to monitor<br>• AC power cord is not securely connected to charger<br>• *AC outlet is not "live"*<br>• Fuses F1 and/or F2 (on main board) are blown<br>• P2 on main board is disconnected<br>• J11 on main board is disconnected or loose | Connect AC charger<br>Connect charger cord securely to side panel connector<br>Connect cord to charger<br><br>Connect the power cord to a live outlet<br>Replace fuses<br>Connect P2<br>Connect J11 |
| Leaks in NIBP system | • NIBP cuff connector is loose at side panel<br>• Defective cuff<br>• Defective hose | Tighten connector<br>Replace cuff<br>Replace hose |
| NIBP not functioning | • NIBP module is not communicating with main board | Power unit off, then on while watching the display. If the screen is blank for 10 seconds after the ALARIS Medical Systems, Inc. logo displays, the NIBP module is not communicating with the main board. Check for the following:<br>• A good connection at J8 on the NIBP board<br>• Flash PROM U18 is completely seated in socket<br>• Good connection at each end of ribbon cable between main board *J8* and *NIBP* module J1 |
| No sound from speaker | • Speaker wire broken at speaker terminals | Repair or replace speaker wires |
| Display backlight doesn't work | • *J2, J4, or J5 on main board is disconnected* or loose | *Connect J2, J4, or J5* |
| Display is blank or not readable | • Contrast is misadjusted<br>• J2 on main board is disconnected or loose | Adjust display contrast in setup menu<br>Connect J1, J3, and/or J4 |
| *RS-232 interface* | • *Cable to DB-9 connector is disconnected* or loose.<br>• J4 on main board is disconnected or loose | Connect cable<br><br>Connect J4 |
| LEDs don't come on | • LEDs are turned off in software | Enter Setup Menu, set LEDs to ON. (Refer to Operator's Manual) |
| Key pad not Operating | • J9 disconnected or loose | Connect J9 |

# Section 9 — Assembly Drawings and Parts Lists

The diagrams contained in this section include assembly drawings with parts lists for the 506DX2 Monitor.

**Title**

NIBP Assy., 506DX2

Final Assy., 506DXNTP2

Rear Encl. Assy., w/ Printer, 506DXNTP2

Rear Encl. Assy., w/o Printer, 506DX2

Bezel Assy., 506DX2

Serial Connectors cable pinouts

## NIBP Assembly Model 506DXNT2

| Ref.# & Dwg.# | Part # | Part Description |
|---|---|---|
| #1, 95541A004 | 40006B002 | Spacer, Nylon #4/.250D/.125L |
| #3, 95541A004 | 91304A003 | NIBP Assembly PCB |
| #4, 95541A004 | 84500B001 | NIBP Pump |
| #11, 95543A004 | 41824B003 | NIBP Manifold |
| #14, 95543A004 | 83089B001 | Valve 3-Way |

## Final Assembly Model

| Ref.# & Dwg.# | Part # | Part Description |
|---|---|---|
| #4, 93929AXXX | 40281B010 | R.H.M.S. 6-32x4.00 |
| #13, 93929AXXX | 41845B003 | NIBP Connector |
| #1, 93929AXXX | 45091B003 | Membrane Switch |
| #8, 93929AXXX | 45076B001 | Receptacle, Panel Patient Input |
| #6, 93929AXXX | 45076B002 | Receptacle, Panel Pwr./Data |
| #5B, 93929AXXX | 46087B003 | Receptacle, Lbl. SpO2, NIBP, Temp. |
| #5C, 93929AXXX | 46088B002 | Receptacle,Lbl. Pwr./Data Com. |
| #5D, 93929AXXX | 46099B001 | Rear Label, IVAC 506DX2 |
| #16, 93929AXXX | 91310A003 | Temperature Assy. PCB |
| #2, 93929AXXX | 45074B001 | Front Bezel |
| #12, 93929AXXX | 91304A002 | NIBP Assy. PCB |
| #19, 93929AXXX | 45070B001 | Probe Cover Box Holder (new style) |

## Rear Encl, Assy. W/ Prnter-506DXNTP2

| Ref.# & Dwg.# | Part # | Part Description |
|---|---|---|
| #1, 93257A002 | 41903C002 | Enclosure, Alum., Printer Mod. |
| #4, 93257A002 | 80029B001 | Battery |
| #5, 93257A002 | 83111B001 | Printer Cable |
| #9, 93257A002 | 80040B002 | Printer, Thermal |
| #10, 93257A002 | 41696B001 | Print/Paper Carrier |
| #11, 93257A002 | 45054B001 | Printer/Paper. Carrier Door |
| #12, 93257A002 | 91311A001 | Printer Assy. PCB |
| #13, 93257A002 | 90788A002 | Battery Cable Assy. |
| #14, 93257A002 | 80111B002 | Tape, Dbl. Sided Foam |
| #15, 93257A002 | 41953B001 | Battery Bracket |
| #16, 93257A002 | 41537B002 | Foam Disk 1.38 dia .12 thk |
| #18, 93257A002 | 41955B001 | Tape, Dbl. sided Foam |
| #19, 93257A002 | 40683B001 | Tape, Transfer Adh. 5mil. |
| #20, 93257A002 | 41868B002 | Insulator, Printer Cable |
| #21, 93257A002 | 41527B001 | Feet, Adhesive Hemisphere |

## Rear Encl. Assy. w/o Printer, Model 506DXNT2

| Ref.# & Dwg.# | Part # | Part Description |
|---|---|---|
| #1, 93257A001 | 41903C001 | Enclosure Alum. |
| #4, 93257A001 | 80029B001 | Battery |
| #3, 93257A001 | 41953B001 | Battery Bracket |
| #4, 93257A001 | 90788A002 | Battery Cable Assy. |
| #6, 93257A001 | 41537B002 | Foam Disk, 1.38 Dia.x.12 Thk. |
| #7, 93257A001 | 41527B001 | Feet, Adhesive, Hemisphere |
| #8, 93257A001 | 41955B001 | Tape, Dbl. Sided Foam |

## Bezel Assy., Model 506DXNT2

| Ref.# & Dwg.# | Part # | Part Description |
|---|---|---|
| #5, 92511A001 | 41527B001 | Feet, Adhesive, Hemisphere |
| #8, 92511A001 | 41927B001 | Insulator. PCB Assy. |
| #9, 92511A001 | 45074B001 | Front Bezel |
| #10, 92511A001 | 81508B001 | Liquid Crystal Display |
| #11, 92511A001 | 91307A003 | Main Assy. PCB |
| #12, 92511A001 | 91308A001 | Comm./Printer Assy. PCB |
| #13, 92511A001 | 91309A001 | Display Assy. PCB |
| Not Shown | 82003B001 | Fuse, 2A Pico, 125v, Slo-Blo |
| Not Shown | 82004B001 | Fuse, 3A Pico, 125v, Slo-Blo |
| Not Shown | 141886 | A/C Adapter |

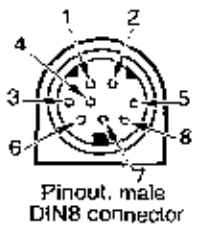
## Serial Port Connection

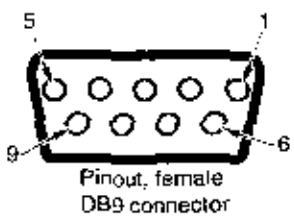
The 506DXNTP2 software versions 1.1 and following support the use of the serial port (7-pin DIN) for outputting trend data to an external serial printer or computer. Serial printer cable CSI Cat. No. 931S can be used for either a printer or computer connection in order to capture this data.

The Seiko DPU-414 printer requires a "non-typical" serial connection. It is pinned out as a modem would-be (DCE - data communications equipment) rather than as a typical printer/computer (DTE - data terminal equipment). The above cable could work with the DPU-414, but only with the attachment of a null-modem adaptor and a DB-9 gender changer. Alternatively, a special 7-pin DIN to DB-9 male cable for the Seiko could be constructed, using the following 2-wire pinout:

| | DIN | | DB-9 MALE |
|---|---|---|---|
| GND | 7 | ---------- | 5 |
| OUT | 5 | ---------- | 3 |

Refer to Figure 9-1 for details.




Pinout Table

| DIN | DB9 | Color |
|---|---|---|
| 7 | 5 | Blue |
| 3 | 3 | Brown |
| 5 | 2 | Yellow |
| 4 | 9 | Red |

**Figure 9-1. Serial Cable Connector Pinouts.**

# Section 10 — Accessories

## Accessories

| Number | Description |
|---|---|
| BP CUFFS | |
| Cat. 672 | NIBP Cuff - Newborn |
| Cat. 473 | NIBP Cuff - Child |
| Cat. 474 | NIBP Cuff - Sm Adult |
| Cat. 475 | NIBP Cuff - Adult |
| Cat. 476 | NIBP Cuff - Large Adult |
| Cat. 477 | NIBP Cuff - Thigh |
| Cat. 745 | Disp. NIBP Cuff - Newborn |
| Cat. 746 | Disp. NIBP Cuff - Child |
| Cat. 747 | Disp. NIBP Cuff - Sm Adult |
| Cat. 748 | Disp. NIBP Cuff - Adult |
| Cat. 749 | Disp. NIBP Cuff - Large Adult |
| Cat. 750 | Disp. NIBP Cuff - Thigh |
| Cat. 740 | Neonatal NIBP Cuff - 3cm-6cm |
| Cat. 741 | Neonatal NIBP Cuff - 4cm-8cm |
| Cat. 742 | Neonatal NIBP Cuff - 6cm-11cm |
| Cat. 743 | Neonatal NIBP Cuff - 7cm-13cm |
| Cat. 744 | Neonatal NIBP Cuff - 8cm-15cm |
| SENSORS | |
| Cat. 511SD | Reuseable sensor- 3ft |
| Cat. 511-10D | Reuseable sensor - 1 Oft |
| Cat. 934SD | Reuseable shell sensor- 3ft |
| Cat. 934-10D | Reuseable shell sensor- 10ft |
| Cat. 934SH | Shell replacement |
| Cat. 511HP | 5451 sensor and 5459 patient cable |
| Cat. 934HP | 5453 sensor and 5459 patient cable |
| Cat. 518DD | Patient sensor cable 10ft |
| Cat. 573SD | Neonatal Disp sensor (Box of 25) |
| Cat. 572SD | Infant Disp sensor (Box of 25) |
| Cat. 571SD | Pediatric Disp sensor (Box of 25) |
| Cat. 570SD | Adult Disp sensor (Box of 25) |
| Cat. 574SD | Variety Disp. sensor 10-adult, 5-ped, 5-infant, 5-neo |

SENSORS CONTINUED

| | |
|---|---|
| Cat. 940SD | Reuseable Multi-Site sensor w/access |
| Cat. 940HP | Multi-Site package |
| Cat. 920 | Foam finger wrap |
| Cat. 914 | Forehead applicator and headband |
| Cat. 915 | Ear clip attachment |
| Cat. 519 | Headband only (for Multi-Site) |
| Cat. 525 | Doublesided adhesive dots (pkg of 50) |
| Cat. 526 | Tape Microfoam (4" strips, pkg of 14) |

TEMP PROBES

| | |
|---|---|
| Cat. 444 | Temp. probe - oral |
| Cat. 445 | Temp. probe - rectal |
| Cat. 446 | Probe covers - box of 20 |
| Cat. 447 | Prove covers - case of 200 |

NIBP AIR HOSES

| | |
|---|---|
| Cat. 707 | NIBP coil hose (10ft) |
| Cat. 706 | NIBP hose (10ft) |
| Cat. 713 | Neonatal NIBP hose (4ft) |

POWER SUPPLIES

| | |
|---|---|
| Cat. 508U | AC charger 110/220V, 50/60Hz |

OTHER

| | |
|---|---|
| Cat. 553/5 | Printer paper (box of 5) |

# Section 11 — Incoming Inspection

## Purpose

The purpose of this procedure is to provide a performance inspection procedure for incoming monitors.

## Associated Material

| Instrument | Recommended Model |
|---|---|
| Test Finger Sensor | Model No. 511 or 934 |
| A/C Adapter Cable | Cat.No. 508U |
| $SpO_2$ Simulator | Model No. 913AD |
| NIBP Simulator | Dynatech Cufflink |
| Probe Simulator Kit | Alaris P/N 143364 |
| Temp Probe | Cat. No. 444 |

## Setup

Connect the equipment under test (EUT) to A/C power using the A/C adapter cable. Verify a green LED lights up the A/C power Symbol on the front membrane. Turn the EUT on by pressing the power button on the front membrane and verify that all LED's light momentarily.

## NIBP Test

Connect EUT to a Dynatech Nevada NIBP simulator and set it for 120/80 operation. Press the START NIBP STAT STOP key. The EUT should take a NIBP reading. The systolic and diastolic readings should appear on the LCD within +/- 5mm Hg of the setting on the simulator, which ever is greater. Connect EUT to a Dynatec Nevada NIBP simulator and set it for 80/50 operation. Set the EUT up into neonate mode. Press the START NIBP STAT STOP key the EUT should take a NIBP reading. The systolic and diastolic readings should appear on the LED's within +/- 5mmHg or of the setting on the simulator, which ever is greater. Verify a green LED lights up the neonate symbol on the front membrane.

**PASS** ☐

**FAIL** ☐

## Oximeter Test

Using a Cat. No. 5352 SpO2 finger sensor, verify heart rate and plethysmograph operation displayed on the LED's within 15 seconds. Verify no SpO2 error messages appear (alarm violations may occur depending on individual readings and monitor setup). Connect the SpO2 simulator to the Model 4400 monitor. Turn the monitor off, then on. Verify the readings stated on the simulator.

**PASS** ☐

**FAIL** ☐

## Temperature Test

Verify the EUT displays the correct temperature in MONITOR mode using the IVAC temperature simulator. Insert the probe simulator cord into the phone plug receptacle on the side of the EUT. Verify that each simulator setting results in the correct reading being displayed on the EUT.

| Simulator Setting | Thermometer Reading |
|---|---|
| 80.2 | 80.2+/-0.2°F(26.7+/-0.1°C) |
| 98.0 | 98.0+/-0.2°F(36.7+/-0.1°C) |
| 98.6 | 98.6+/-0.2°F(37.0+/-0.1°C) |
| 102.0 | 102.0+/-0.2°F(38.9+/-0.1°C) |
| 107.8 | 107.8+/-0.2°F(42.1 +/-0.1°C) |
| B.P. | 106.0+/-0.2°F(41.1 +/-0.1°C) |

**PASS** ☐

**FAIL** ☐

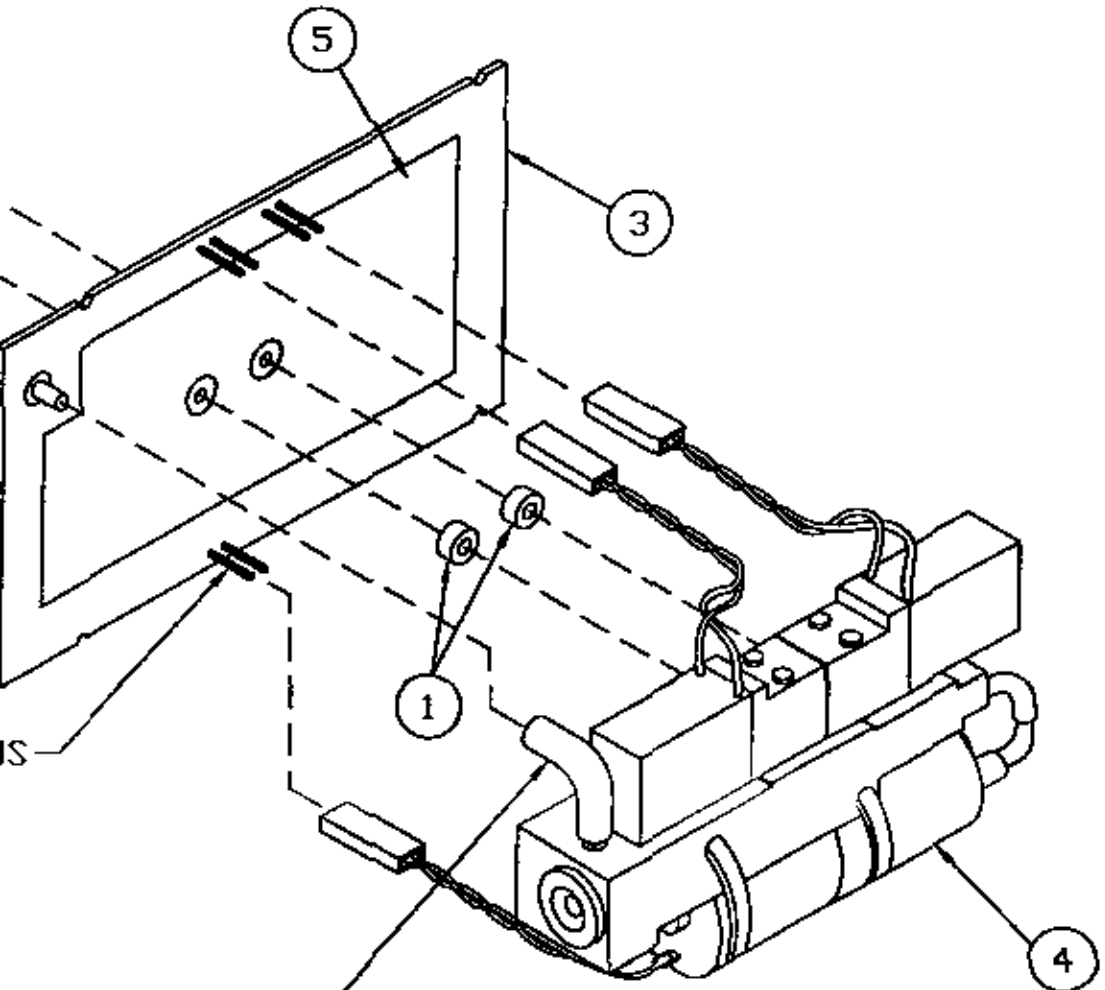
## Safety Tests

Verify the EUT passes the leakage performance as described in chapter four of this manual.

**PASS** ☐

**FAIL** ☐

| REVISIONS | | | |
|---|---|---|---|
| REV. | DATE | DESCRIPTION | BY |
| 1 | 10/6/98 | SEE ECN 6570L | |



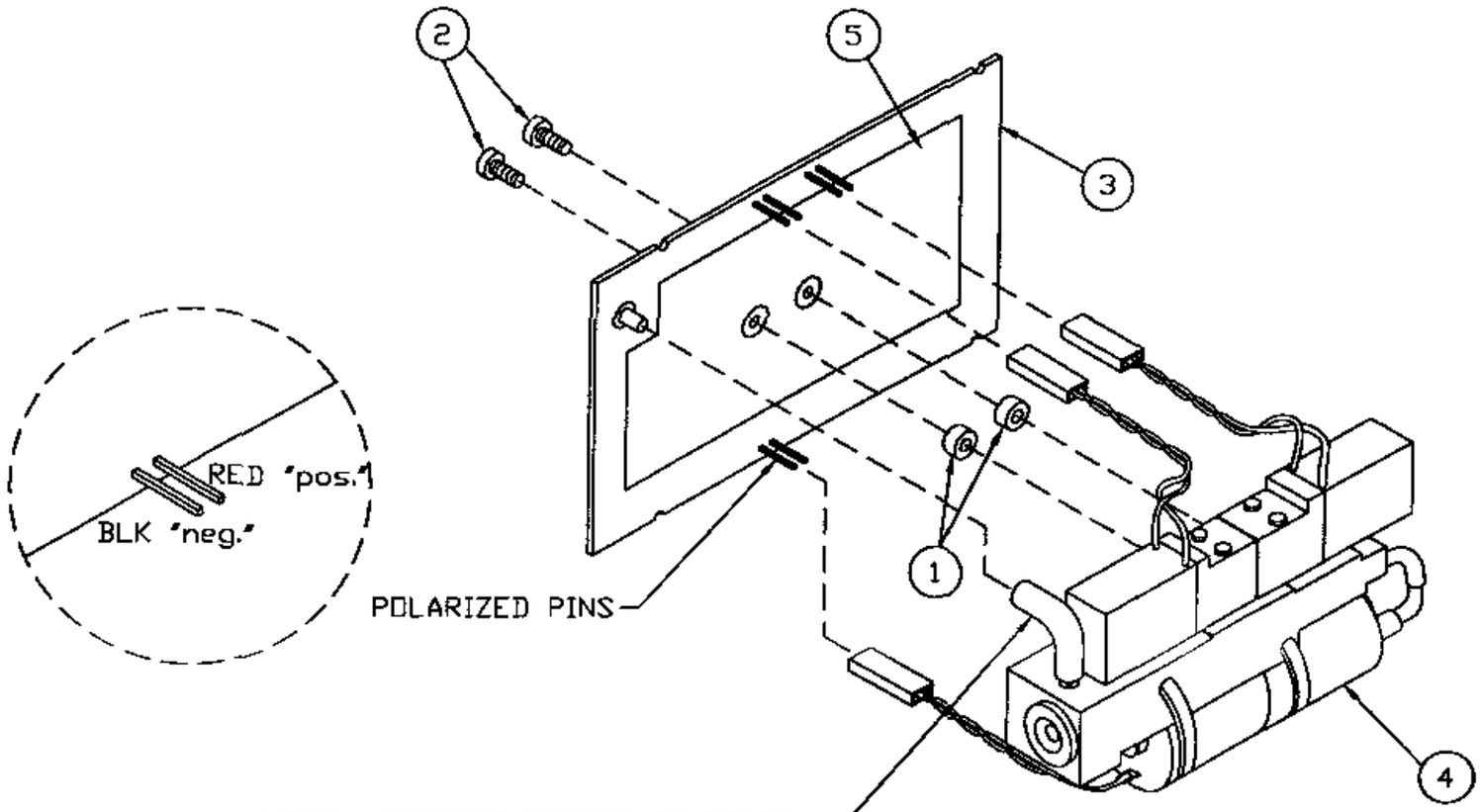

NG TO BOARD
RE ATTACHING
FOLD TO PCB.

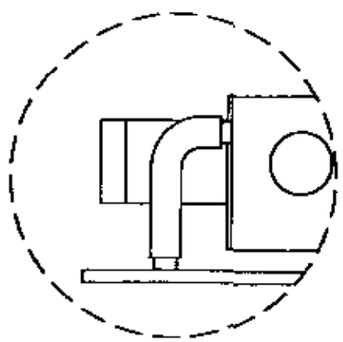
LY BEND MOTOR
OUTWARD TO
MODATE CONNECTION.

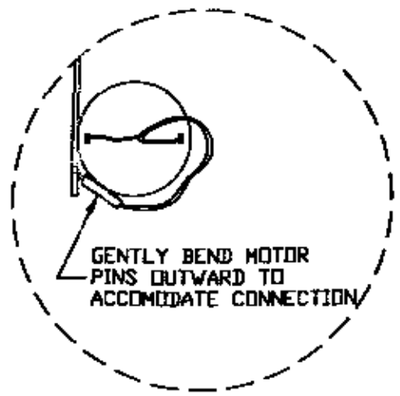
| CRITICARE SYSTEMS, INC. | | |
|---|---|---|
| DRAWN P.SIMON | CHECK | ENGR. APPR. P. SIMON 8/31/98 |
| DATE 5/22/98 | RELEASE DATE | QA APPR. K. LARSEN 9/2/98 |
| SCALE FULL | DO NOT SCALE PRINT | MFG. APPR. K. SCHMITZ 8/31/98 |
| TOLERANCE UNLESS OTHERWISE SPECIFIED .XX +/- .010 .XXX +/- .005 ANGLES +/- 1 DEGREE | CONFIDENTIAL: THIS DOCUMENT CONTAINS CONFIDENTIAL INFORMATION AND MAY NOT BE COPIED OR DEVULGED WITHOUT WRITTEN CONSENT OF CRITICARE SYSTEMS, INC. | |
| TITLE ASSY, NIBP ALUMINUM MANIFOLD 506DX FAMILY | PART NO. 95541A004 | REV. 1 |
| | SIZE 302 | SHEET 1 OF 1 |

| ITEM NO. | PART NO. | DESCRIPTION | NO. REQ'D |
|---|---|---|---|

| REVISIONS | | | |
|---|---|---|---|
| REV. | DATE | DESCRIPTION | BY |
| 1 | 10/6/98 | SEC ECN #5701 | JBR |



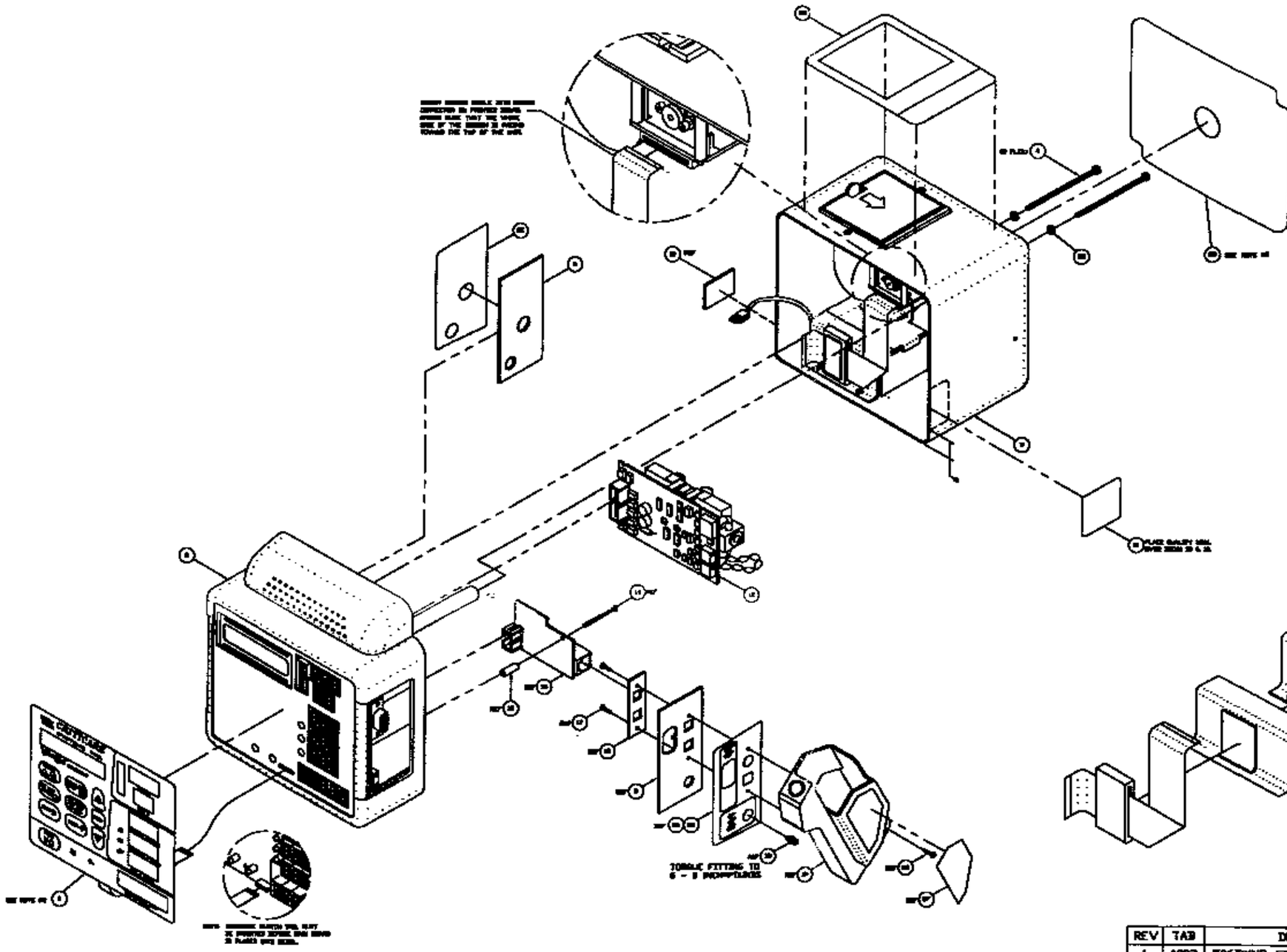


FINAL TUBING ORIENTATION

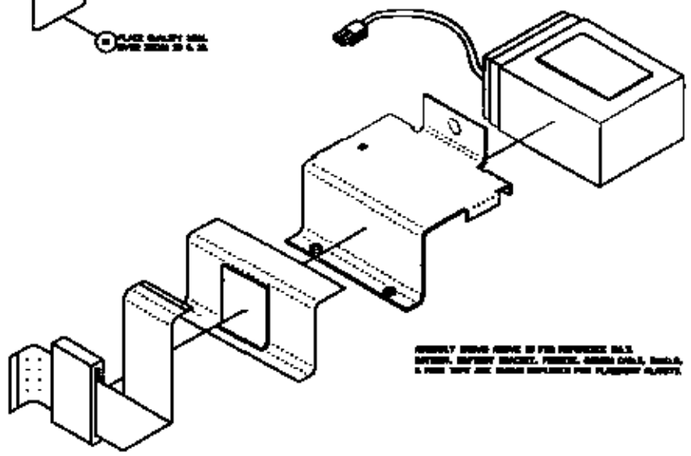



**CRITICARE SYSTEMS, INC.**

| | | |
|---|---|---|
| DRAWN BY P.SIMON | CHECK BY | ENG. APPR. P. SIMON 8/31/98 |
| DATE 5/22/98 | RELEASE BOARD | QA APPR. M. LARSEN 9/2/98 |
| SCALE FULL | DO NOT SCALE PRINT | MFG. APPR. K. SCHMITZ 8/31/98 |
| TOLERANCE UNLESS OTHERWISE SPECIFIED XX +/- .XX XXX +/- .XXX ANGLES +/- 1 DEGREE | CONFIDENTIAL: THIS DOCUMENT CONTAINS CONFIDENTIAL INFORMATION AND MAY NOT BE COPIED OR DIVULGED WITHOUT WRITTEN CONSENT OF CRITICARE SYSTEMS, INC. | |

| | | |
|---|---|---|
| TITLE ASY, NIBP ALUMINUM MANIFOLD 506DX FAMILY | PART NO. 95541A004 | REV. 1 |
| | SIZE 302 | SHEET 1 OF 1 |



| REV | TAB | DESCRIPTION |
|---|---|---|
| 1 | A002 | 506DXNP FINAL ASSY |
| 1 | A003 | 506DXNTP FINAL ASSY |
| 1 | A008 | 506DXNTP-ALARIS FINAL ASSY |

LABEL CONFIGURATION BY PRODUCT

| ITEM # | 93930A002 | 93930A003 | 93930A008 |
|---|---|---|---|
| 5A | 460873B006 | - | - |
| 5B | - | 460873B007 | 460873B007 |
| 5C | 460888B002 | 460888B002 | 460888B002 |
| 5D | 460901B001 | 460901B001 | 460993B001 |
| 5E | 461128B001 | 461128B001 | - |
| 5F | - | 461321B001 | 461331B001 |
| 5G | 461463B001 | 461463B001 | 461463B001 |

***FRONT VIEW***

NOTES:

1. ITEM P/N SUBASSEMBLY UNIT ITEMS.
   15 THRU 22 FROM FINAL ASSEMBLY.
2. P/N SUBASSEMBLY MUST HAVE THE APPROPRIATE ALARIS FRONT MEMBRANE SWITCH AND LABEL SHEET.
3. ITEM "5C" IS LOCATED ON THE CAT LEVEL OF THE INTERNATIONAL MODELS OF THE 506.
4. ITEM #5A THRU #5F ARE PART OF THE SUB ASSEMBLIES 93924A002 AND 93924A003.

**CRITICARE SYSTEMS, INC.**

| | | | |
|---|---|---|---|
| DRAWN P. SIMON | | DES. APPR. P. SIMON 5/27/98 | |
| DATE 5/20/98 | | DES. APPR. P. LARSEN 5/27/98 | |
| FINISH FULL | DO NOT SCALE PRINT | DES. APPR. M. SCHMITZ 5/28/98 | |

TOLERANCE UNLESS OTHERWISE SPECIFIED
.XX +/- .010
.XXX +/- .005
ANGLES +/- 1 DEGREE

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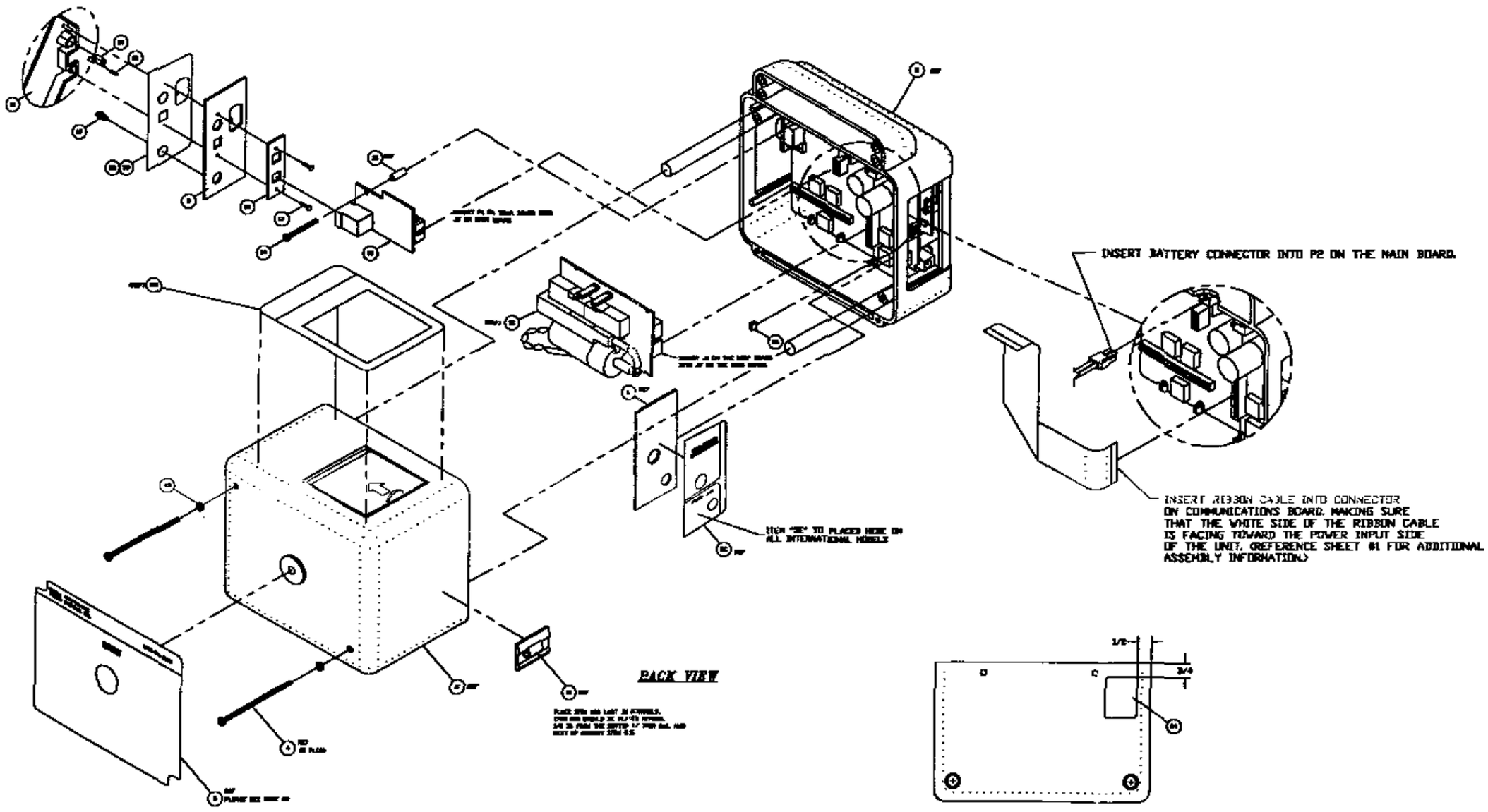
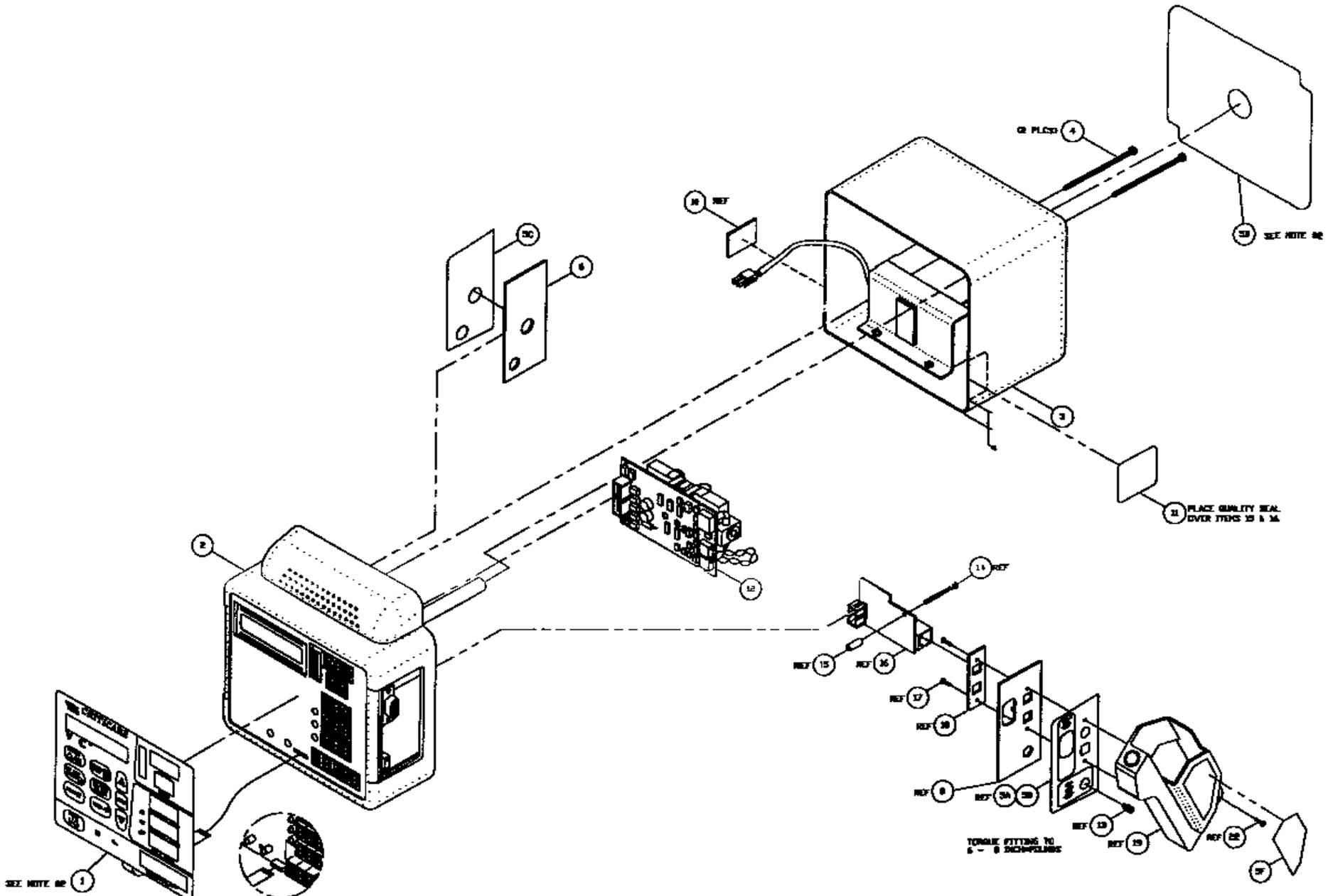
TITLE: 506DX SERIES PHASE II PRINTER VERSION FINAL ASSY

PART NO. 93930AXXX REV. 1

SIZE A2 SHEET 1 OF 2


INSERT BATTERY CONNECTOR INTO P2 ON THE MAIN BOARD.
INSERT RIBBON CABLE INTO CONNECTOR ON COMMUNICATIONS BOARD MAKING SURE THAT THE WHITE SIDE OF THE RIBBON CABLE IS FACING TOWARD THE POWER INPUT SIDE OF THE UNIT. (REFERENCE SHEET #1 FOR ADDITIONAL ASSEMBLY INFORMATION)
BACK VIEW

| CRITICARE SYSTEMS, INC. | | |
|---|---|---|
| P.SIMON | | |
| 5/20/98 | | |
| 21 | DO NOT SCALE PRINT | |
| | CONFIDENTIAL: THIS DOCUMENT CONTAINS CONFIDENTIAL INFORMATION AND MAY NOT BE COPIED OR DISCLOSED WITHOUT WRITTEN CONSENT OF CRITICARE SYSTEMS, INC. | |
| 506DX SERIES PHASE 2 PRINTER VERSION FINAL ASSY | 93930AXXX | 1 |
| 302 | 2 OF 2 | |




| REV | TAB | DESCRIPTION |
|---|---|---|
| 0 | A002 | 506IXN FINAL ASSY |
| 0 | A003 | 506IXNT FINAL ASSY |
| 0 | A008 | 506IXNT-V FINAL ASSY |

LABEL CONFIGURATION BY PRODUCT

| ITEM # | 93929A002 | 93929A003 | 93929A008 |
|---|---|---|---|
| 5A | 460878006 | - | - |
| 5B | - | 460878007 | 460878007 |
| 5C | 460888002 | 460888002 | 460888002 |
| 5D | 460908001 | 460908001 | 460998001 |
| 5E | 461288001 | 461288001 | 461288001 |
| 5F | - | 461328001 | 461338001 |

***FRONT VIEW***

NOTES:

1. FOR P/N 93929AXXX UNIT ITEMS 6C-6E FROM FINAL ASSEMBLY.
2. P/N SUPERVISOR MUST HAVE THE APPROPRIATE ALARMS FRONT MEMBRANE SWITCH AND LABEL SHEET.
3. ITEM "2E" IS LOCATED ON THE CAT LEVEL OF THE INTERNATIONAL MODELS OF THE 506.
4. ITEMS 6DA THRU 6DF ARE PART OF THE SUB ASSEMBLIES 93929A001 AND 93929A001.

**CRITICARE SYSTEMS, INC.**

| | | |
|---|---|---|
| P. SIMON | | |
| 5/20/98 | | |
| 21 | DO NOT SCALE PRINT | |

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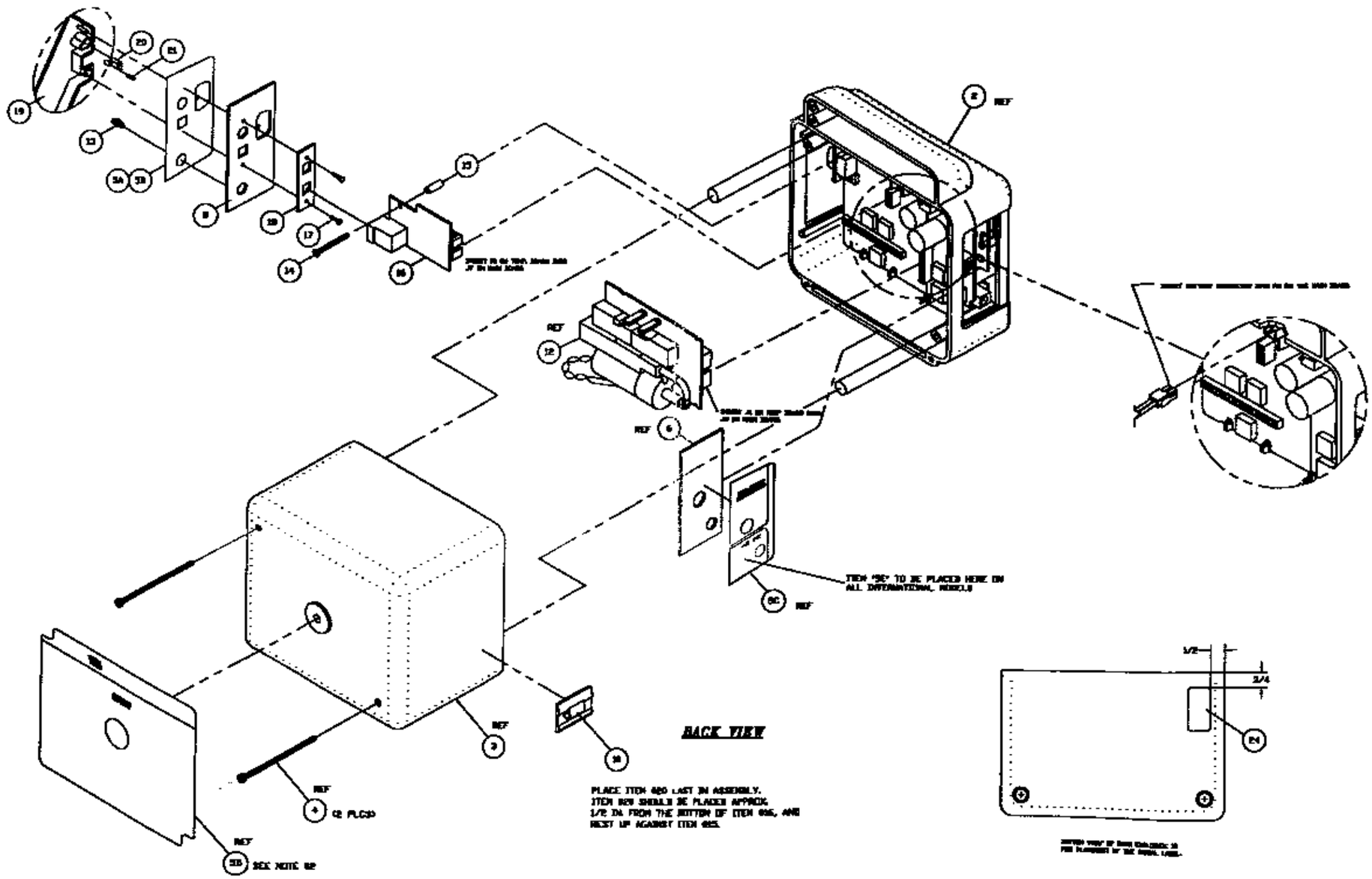
506IX SERIES PHASE 2 NON-PRINTER VERSIONS FINAL ASSY

93929AXXX | 0

SHEET 1 OF 2


TEM "9C" TO BE PLACED HERE ON
ALL INTERNATIONAL MODELS
REF
REF
REF

| REV | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 1 | 6/20/97 | SPEC ECN 92511 | SDL |
| 2 | 8/20/97 | SPEC ECN 92511 | SDL |
| 3 | 10/24/97 | SPEC ECN 92511 | SDL |
| 4 | 2/24/98 | SPEC ECN 92511 | SDL |
| 5 | 3/24/98 | SPEC ECN 92511 | SDL |

*BACK VIEW*

*FRONT VIEW*

| PART NUMBER | DESCRIPTION |
|---|---|
| 92511A001 | 506DX |
| 92511A002 | 506DX PHASE 2 |

| | | |
|---|---|---|
| DSL | | P. SIMON |
| 4/8/97 | | A. KAPLAN |
| 12 | DO NOT SCALE PRINT | B. FINTEL |

CRITICARE SYSTEMS, INC.

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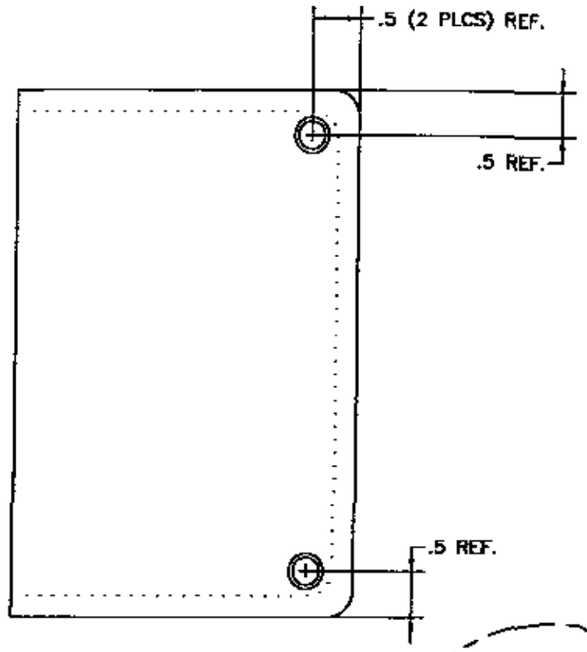
AY BEZEL
506DX FAMILY

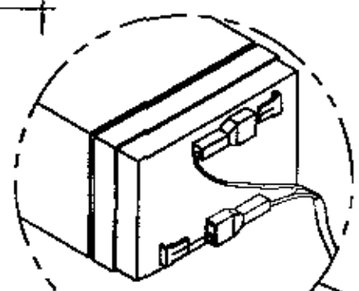
92511A001 | 5

302 | 1 | 1

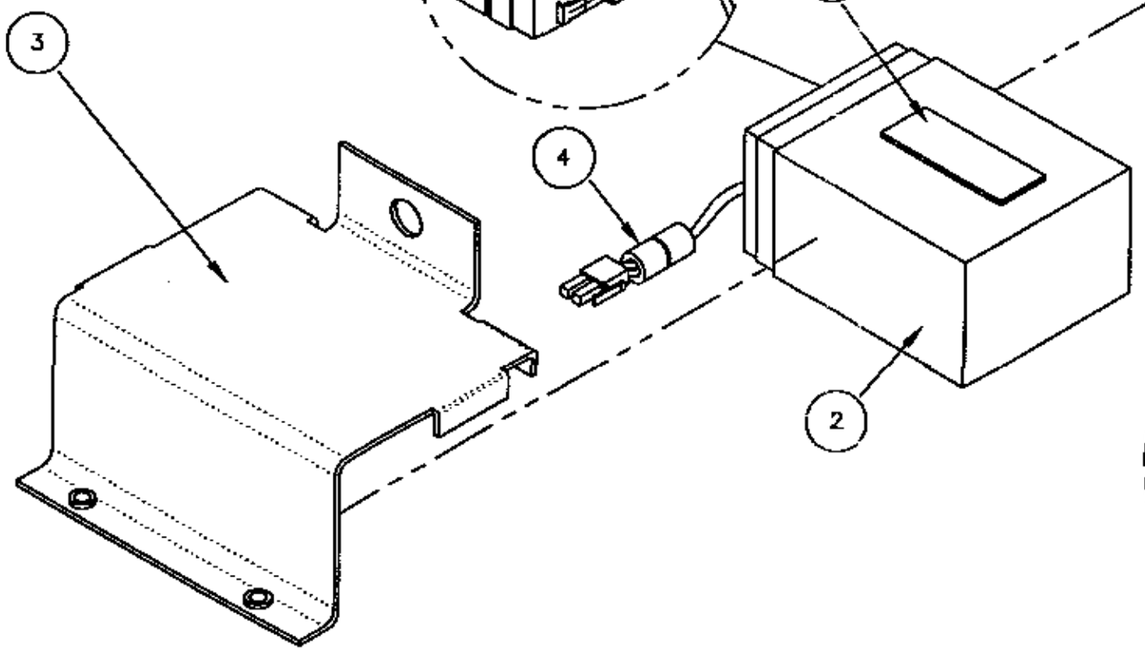
| REVISIONS | | | |
|---|---|---|---|
| REV. | DATE | DESCRIPTION | BY |
| 1 | 6/15/97 | SEE ECN #5141 | DBL |
| 2 | 9/25/98 | SEE ECN #5694 | DBL |

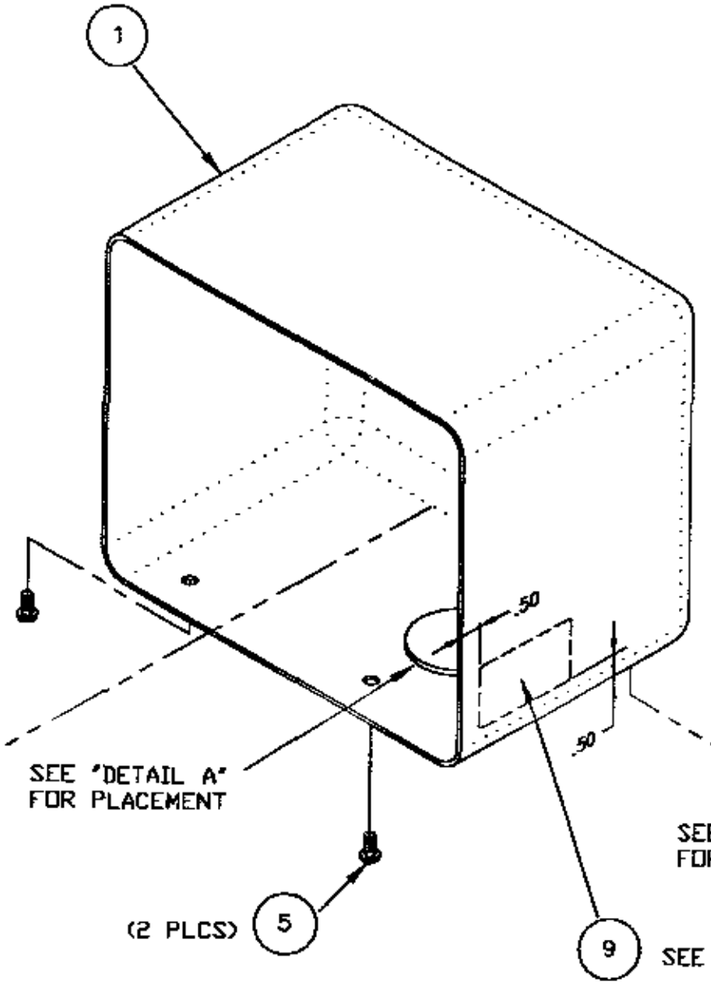


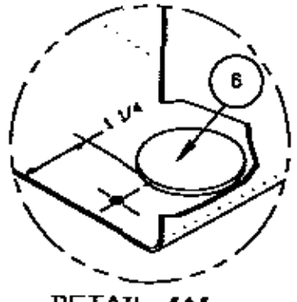

BOTTOM VIEW



FOAM TAPE DIMENSIONS
1" WIDE X 1 1/2" LONG




DETAIL "A"

NOTES:

1. PLACE ITEM #9 (CSI P/N 46148B001) INSIDE *AGAINST RIGHT OF REAR ENCLOSURE. .50 FROM* BOTTOM AND .50 FROM FRONT.

**CRITICARE SYSTEMS, INC.**

| | | |
|---|---|---|
| DRAWN DBL | CHECK | ENG. APPR. P. SIMON |
| DATE 5/20/97 | RELEASE DATE | D.A. APPR. B. FINTEL |
| SCALE 1:1.5 | DO NOT SCALE PRINT | MFG. APPR. A. KAPLAN |

TOLERANCE UNLESS OTHERWISE SPECIFIED: XX: +/- .030 XXX: +/- .005 ANGLES: +/- 1 DEGREE

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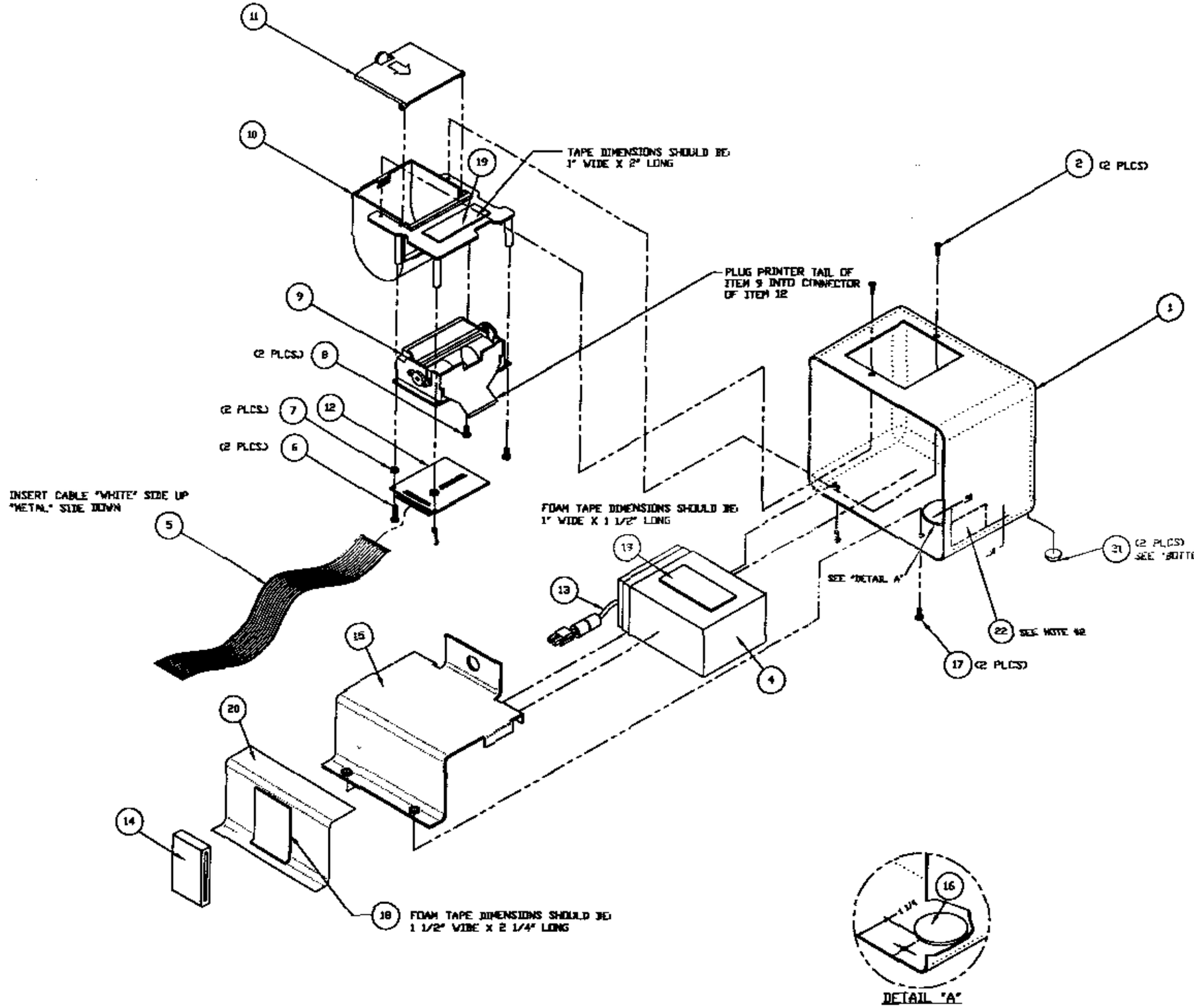
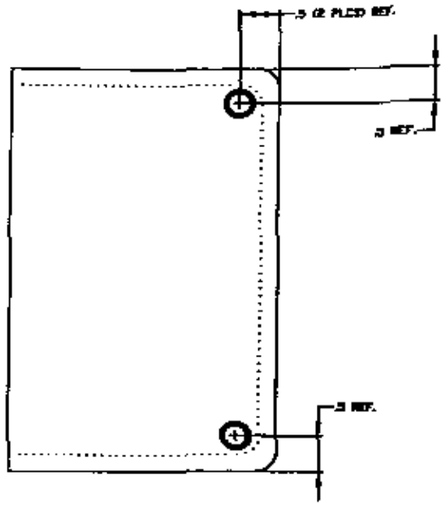
| | | |
|---|---|---|
| TITLE REAR ENCLOSURE AY 506DX | PART NO. 93257A001 | REV. 2 |
| | CAGE 302 | SHEET 1 OF 1 |




BOTTOM VIEW

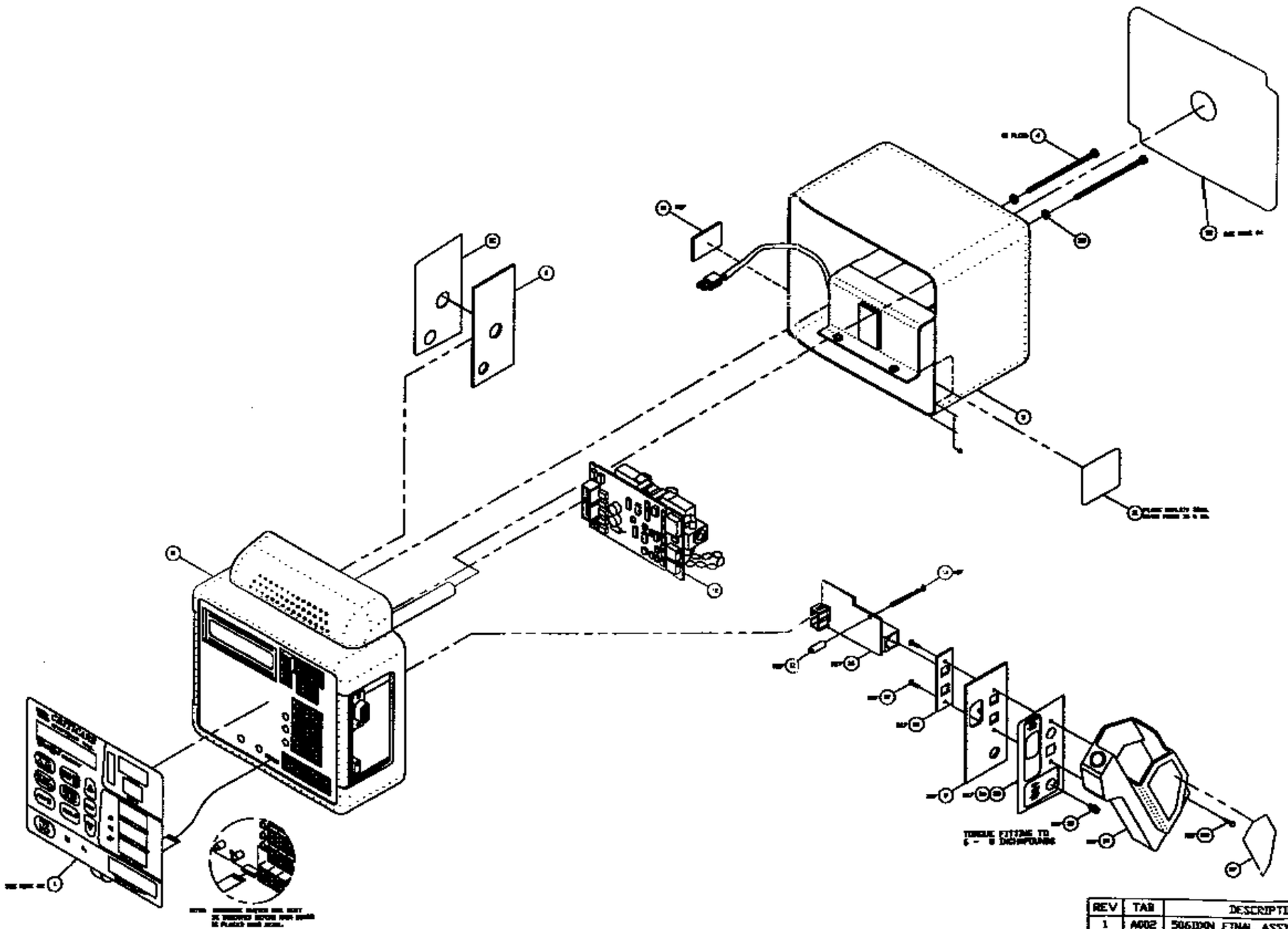



DETAIL "A"

NOTES:

1. THE CIRCULAR FOAM PAD IS LOCATED IN LINE WITH THE CENTER OF THE BATTERY BRACKETS MOUNTING HOLES AS SHOWN ON DETAIL "A".
2. PLACE ITEM #22 (CSI P/N 46148B001) INSIDE AGAINST RIGHT OF REAR ENCLOSURE .59 FROM BOTTOM AND .59 FROM FRONT.

| CRITICARE SYSTEMS, INC. | | | |
|---|---|---|---|
| DRAWN B. PELOWSKI | | CHK'D P. SIMON 5/16/97 | |
| DATE 4/4/97 | | APPD A. APLAN 5/19/97 | |
| SCALE 1/2 | DO NOT SCALE PRINT | MFG J. FINTEL 5/23/97 | |
| TOLERANCE UNLESS OTHERWISE SPECIFIED DO +/- .XXX FOR +/- .XXX ANGLES +/- 1 DEGREE | CONFIDENTIAL: THIS DRAWING CONTAINS CONFIDENTIAL INFORMATION AND MAY NOT BE COPIED OR DISCLOSED WITHOUT WRITTEN CONSENT OF CRITICARE SYSTEMS, INC. | | |
| TITLE REAR ENCLOSURE AY W/PRINTER 506DX | | PART NO. 93257A002 | REV. 2 |
| | | SHEET 302 | SHEET 1 OF 1 |



| REV | TAB | DESCRIPTION |
|---|---|---|
| 1 | A002 | 506DXN FINAL ASSY |
| 1 | A003 | 506DXNT FINAL ASSY |
| 1 | A008 | 506DXNT-V FINAL ASSY |

LABEL CONFIGURATION BY PRODUCT

| ITEM # | 93929A002 | 93929A003 | 93929A008 |
|---|---|---|---|
| 5A | 460878006 | - | - |
| 5B | - | 460873007 | 460873007 |
| 5C | 460888002 | 460883002 | 460883002 |
| 5D | 460900001 | 460901001 | 460901001 |
| 5E | 461288001 | 461283001 | 461283001 |
| 5F | - | 461323001 | 461333001 |

***FRONT VIEW***

NOTES:

1. ITEM P/N 93929A008 UNIT ITEMS RES-EE FROM FINAL ASSEMBLY.
2. P/N 93929A008 MUST HAVE THE APPROPRIATE ALARMS FRONT MEMBRANE SWITCH AND LABEL SHEET.
3. ITEM "5E" IS LOCATED ON THE CAT LEVEL OF THE INTERNATIONAL ROBELS OF THE 506L
4. ITEM 63A THRU 63F ARE PART OF THE 3MM ASSEMBLIES 900843A001 AND 900844A001.

**CRITICARE SYSTEMS, INC.**

| | | | |
|---|---|---|---|
| P. SIMON | | P. SIMON 5/27/98 | |
| 5/20/98 | | A. LARSEN 5/28/98 | |
| 21 | DO NOT SCALE PRINT | X. SCHMITZ 6/23/98 | |

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506DX SERIES PHASE 2 NON-PRINTER VERSIONS FINAL ASSY

93929AXXX | 1

SHEET 1 OF 2